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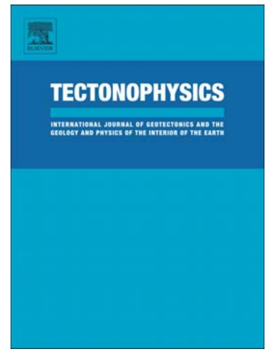

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Detrital zircon age distribution from Devonian and Carboniferous sandstone in the Southern Variscan Fold-and-Thrust belt (Montagne Noire, French Massif Central), and their bearings on the Variscan belt evolution

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Abstract

In the Southern French Massif Central, the Late Paleozoic sedimentary sequences of the Montagne Noire area provide clues to decipher the successive tectonic events that occurred during the evolution of the Variscan belt. Previous sedimentological studies already demonstrated that the siliciclastic deposits were supplied from the northern part of the Massif Central. In this study, detrital zircon provenance analysis has been investigated in Early Devonian (Lochkovian) conglomerate and sandstone, and in Carboniferous (Visean to Early Serpukhovian) sandstone from the recumbent folds and the foreland basin of the Variscan Southern Massif Central in Montagne Noire. The zircon grains from all of the samples yielded U-Pb age spectra ranging from Neoarchean to Late Paleozoic with several age population peaks at 2700 Ma, 2000 Ma, 980 Ma, 750 Ma, 620 Ma, 590 Ma, 560 Ma, 480 Ma, 450 Ma, and 350 Ma. The dominant age populations concentrate on the Neoproterozoic and Paleozoic. The dominant concordant detrital zircon age populations in the Lochkovian samples, the 480-445 Ma with a statistical peak around 450 Ma, are interpreted as reflecting the rifting event that separated several continental stripes, such as Armorica, Mid-German Crystalline Rise, and Avalonia from the northern part of Gondwana. However, Ediacaran and Cambrian secondary peaks are also observed. The detrital zircons with ages at 352-340 Ma, with a statistical peak around 350 Ma, came from the Early Carboniferous volcanic and plutonic rocks similar to those exposed in the NE part of the French Massif Central. Moreover, some Precambrian grains recorded a more complex itinerary and may have experienced a multi-recycling history: the Archean and Proterozoic grains been firstly deposited in Cambrian or Ordovician terrigenous rocks, and secondly re-sedimented in Devonian and/or Carboniferous formations. Another possibility is that ancient grains would be inherited grains, scavenged from an underlying but not exposed Precambrian basement.

Keywords: Detrital zircon provenance analysis; Foreland basin; Fold-and-Thrust belt; Variscan Belt; Montagne Noire

1. Introduction

Sedimentological and provenance studies of the terrigenous detritus found in the foreland basins are used since a long time to analyze the geomorphologic and tectonic evolution of orogens, particularly the uplift and erosion of the inner zones of mountain belts. More recently, age distribution probability of detrital zircon enclosed in terrigeneous unmetamorphosed or low-grade metasedimentary rocks became a popular method to infer the possible source area of the sediments (e.g. Dickinson and Gerhels, 2009; Fedo et al., 2003). This approach has been applied all along the Paleozoic Variscan belt from Iberia to Turkey, through Central Europe (e.g. Fernández-Suárez et al., 2002, 2003; Martínez Catalán et al., 2004, 2008, 2016; Linnemann et al., 2004; Okay et al., 2011; Dinis et al., 2012). Nevertheless, such inherited detrital zircon provenance analyses are rare in the French Variscan Belt. Studies are limited to the Southern Massif Armoricain (Ducassou et al., 2014) or Massif Central (Melleton et al., 2010). This last work dealt with magmatic and metamorphic rocks: 7 orthogneiss, one metarhyolite, and 6 paragneiss sampled in the western part (Limousin area) of the French Massif Central. Only one Cambrian metasandstone was investigated. Provenance studies from detrital zircon have never been carried out in the southern foreland basin that crops out in the southern part of the French Massif Central. This study focuses on the detrital zircon age distribution of the Late Visean-Early Serpukhovian turbiditic sandstone, and also on Early Devonian (Lochkovian) detrital rocks that unconformably overlie the Ordovician sandstone involved in the recumbent folds of the southern flank of the Montagne Noire (Fig. 1). The significance of the statistical distribution of zircon ages for the tectonic evolution of the French Massif Central is discussed.

2. The Variscan French Massif Central

The Variscan orogen is a complex belt built up by multiple collisions of continents and microcontinents that develops from SW Iberia to Poland over ca 5000 km along strike and 1000 km in width. A general zonation, and several geodynamic evolution models have been proposed (e.g. Matte, 1986, 2001; Cocks, 2000; Franke, 2000, 2014; Martínez Catalán et al., 2009; Faure et al., 2005, 2009; Ballèvre et al., 2009; Schulmann et al., 2009; Lardeaux et al., 2014).

The French Massif Central (FMC; Fig. 1) is one of the largest Variscan massifs. It consists of a stack of nappes developed at the expense of sedimentary and magmatic rocks belonging to the southern margin of Gondwana (e.g. Faure et al., 2009 and enclosed references). From top to bottom, and globally from North to South, the following units are recognized. The Upper Gneiss Unit (UGU) is formed by a bimodal magmatic association (termed the "leptynite-amphibolite complex") with acidic and mafic rocks, and paragneiss. This unit contains high-pressure rocks (eclogites and granulites) dated at ca 420-400 Ma (Pin and Peucat, 1986). The upper part of the UGU consists of migmatites yielding zircon U-Pb ages around 385-380 Ma. The Lower Gneiss Unit (LGU) is composed of metagreywacke, metapelite, metarhyolite, and a small amount of mafic rocks, metamorphosed into amphibolites. Cambrian and Ordovician alkaline porphyritic granites, now transformed into augen orthogneiss, intruded the sedimentary-volcanic series. Like the UGU, the LGU experienced a Late Devonian crustal melting dated around 375-370 Ma. The Para-autochthonous Unit consists of a metapelite-metagreywacke series with rare mafic lava, and intruded by rare orthogneiss. Zircon from the magmatic rocks indicates Ordovician ages. The southernmost part of the FMC contains clastic sediments of Late Viséan to Serpukhovian age, which were incorporated into the grossly southward propagating fold and thrust belt. The southern foreland basin consists of a Middle Visean basin. Since the last two units are well developed in the Montagne Noire that constitutes the topic of this paper, stratigraphic and structural details will be provided in the following section.

Other lithotectonic and magmatic units of the FMC are exposed in limited areas. Devonian rocks crop out in the NE part (Montagne Bourbonnaise and Morvan area, Fig. 1). The Brévenne ophiolitic Unit, exposed west of Lyon, consists of mafic rocks (gabbro, diabase, pillow lava, and volcano-clastites), serpentinites, and siliceous sedimentary rocks (e.g. Pin and Paquette, 1998; Leloix et al., 1999). To the North, the Somme series consists of acidic to intermediate volcanic rocks (lava flows, pyroclastites) interlayered with sandstones, grauwackes, conglomerates and limestones (Delfour, 1989; Schneider et al., 1989). The Somme series and Brévenne ophiolites are interpreted as a magmatic arc and a back arc basin, respectively. This system developed in the upper plate of a South-directed subduction (Faure et al., 2009). The low metamorphic grade Upper Units that develop from the southern margin of Limousin to the Albigeois area, North of the Montagne Noire, consist of Cambrian-Ordovician sedimentary and volcanic formations.

Furthermore, in the northern part of the FMC, the Late Visean "Tufs anthracifères" series formed by conglomerates, sandstone, mudstone with coal measures and rhyolitic to dacitic volcanites and volcano-sedimentary rocks represent an important time marker, as this series unconformably covers the tectono-metamorphic stack of nappes of northern Massif Central whereas, at the same time, in the south, the Fold-and-Thrust belt is still developing. The Variscan magmatism is also well developed in the FMC. After an Early Carboniferous event represented by the biotite (± cordierite) Guéret massif, the Visean magmatism, represented by "red granites", microgranites, and dykes coeval with the "Tufs anthracifères" series, is dominant in the NE Massif Central, in Morvan and Montagne Bourbonnaise (e.g. Duthou et al., 1984; Leistel and Gagny, 1984; Binon and Pin, 1989; Pin and Duthou, 1990; Pin, 1991). Lastly, Serpukhovian to Baskhirian (or Namurian to Westphalian in the W. European stratigraphic scale) plutons, represented by two-mica peraluminous and biotite-K feldspar megacrysts monzogranites, are widespread all over the FMC.

This stack of nappes was built up throughout several tectonic-metamorphic events. A polyorogenic evolution accounts well for the present architecture (e.g. Faure et al., 2009; Fig. 1). In this view, a Silurian-Devonian eo-Variscan cycle was responsible for the development of the high pressure-medium temperature (D_0 event), followed by the crustal melting (D_1 event) observed in the UGU and LGU. The Variscan orogenic cycle developed during the Latest Devonian (Famennian) and Carboniferous. The major tectono-metamorphic event (D_2), coeval with a medium pressure-medium temperature metamorphism, is characterized by a top-to-the-NW ductile shearing. This D_2 event was dated at ca 365-360 Ma (Melleton et al., 2009; Do Couto et al., 2015). The next D_3 event developed in the southern MCF with a clear geographic and chronological evolution. From North-South, the UGU and LGU were reactivated, and transported upon the Para-autochthonous Unit, itself emplaced upon the Fold-and-Thrust Belt, and then in the foreland basin. The consistent top-to-the-South shearing and thrusting became younger and younger from North to South, namely from Early Visean (ca 345 Ma) in the Margeride up to Late Visean- Early Serpukhovian (ca 330-325 Ma) in the Montagne Noire.

At the scale of the entire Massif Central, the Late Visean period represents a turning point since the D_3 nappe stacking active in the southern part was coeval with the onset of orogenic extension in the northern part of the massif. The emplacement of the Late Visean (ca 330 Ma) dyke swarm belonging to the "Tufs Anthracifères" series was controlled by a NW-SE crustal stretching. Nevertheless, the main time for crustal extension, as represented by the syntectonic emplacement of peraluminous granites and K-feldspar porphyritic monzogranites, took place in Late Serpukhovian to

Bashkirian (ca 320-315 Ma; Fig. 1). This tectono-magmatic phase will not be presented here as this event post-dates the deposition of the sedimentary rocks in the foreland basin. On the contrary, the Tournaisian to Middle Visean magmatism observed in the northern FMC will be presented in the discussion section as it might be interpreted as a possible source for the detrital zircons deposited in the Late Visean-early Serpukhovian foreland basin.

3. The Montagne Noire

Since early works (e.g. Gèze, 1949; Arthaud, 1970), the Montagne Noire, in the southernmost part of the FMC, is subdivided into a northern flank and a southern flank formed by folded and thrust sedimentary formations, separated by a metamorphic, granitic, and migmatitic Axial zone (Fig. 2). Due to the low metamorphic grade experienced by the sedimentary series, the southern flank is a well-known area for Paleozoic biostratigraphy (e.g. Alabouvette et al., 2003). In the following, only a brief lithostratigraphic outline is provided here; details can be found in numerous papers (e.g. Engel et al., 1980-1981; Feist, 1985; Feist and Galtier, 1985; Alvaro and Vizcaïno, 1998; Vizcaïno and Alvaro, 2001; Poty et al., 2002; Vachard and Aretz, 2004).

The Early Ordovician rocks (Fig. 3) conformably overlie Early Cambrian green sandstone, grauwacke and limestone. A ca 15-20m thick white massive quartzite covers a 500 to 800 m thick alternation of sandstone, siltstone and mudstone of Tremadocian age. These turbidites are interpreted as contourites (e.g. Alabouvette et al., 2003) deposited along a passive continental margin during the rifting event that separated the Armorica microcontinent from the main part of Gondwana (Matte, 2001; Faure et al., 2009). In the Montagne Noire, the upper Ordovician and Silurian deposits are generally missing, except in the olistoliths known as the "Ecailles de Cabrières" (or Cabrières Schuppen, Fig. 2). There, they consist of mudstone, sandstone, black shale and rare limestone. The absence of the late Ordovician and Silurian rocks is interpreted as a consequence of the emersion and erosion of rift shoulders that followed the early Ordovician rifting (Alabouvette et al., 2003). Under tropical climatic conditions, a Fe-rich laterite developed. The Devonian formations are known only in the southern flank of the Montagne Noire. The Early Devonian (Lochkhovian, ca 416-411 Ma), deposit unconformably overlies the Early Ordovician sandstone (Fig. 4a). The basal conglomerate reworks lithic fragments, laterite, andesites, silcrete, phosphatic clasts, micaschists, volcanic quartz grains, and magmatic or metamorphic minerals such as garnet, zircon, monazite, rutile, tourmaline, allanite (Feist, 1985; Quémart et al., 1993). Sedimentological studies indicate that this material was supplied from a northern source (Feist and Schönlaub, 1973, Feist, 1985, Quémart et al., 1993). The sedimentary series continues with iron rich sandstone, oolithic ferruginous sandstone, and dolomite. This ca 15 m thick basal sequence is overlain by white massive sandstone with quartz arenite called "mur quartzeux" (quartzose wall) reworking abundant zircon, rutile, and tourmaline (Figs 3, 4b).

The Middle and Upper Devonian rocks consist of shallow water limestone and dolomite. The carbonate platform develops widely in the North Gondwana margin in Pyrenees, Mediterranean Variscan massifs, (SE Spain, Calabria, Kabylia, Sardinia, Sicily), and farther East in Middle East, up to SE Asia. The Late Devonian (Famennian) carbonates are represented by typical red nodular limestone known as "griotte facies" (Fig. 3) that denotes a high- energy slope environment indicating the onset of the drawning carbonate platform. The Early Carboniferous (Tournaisian) is represented by a ca 30 m thick black radiolarian chert (lydite), and a ca 20 m thick succession of siliceous limestone, clayed and bioclastic limestone, argillite, breccia and limy turbidite locally known as "calcaire de Faugères". The Devonian carbonate platform that progressively subsided during the Tournaisian was replaced by silico-clastic sedimentation during the Late Visean. The cm-scale alternations of siltstone and sandstone representative of distal turbidite were followed by more proximal deposits characterized by 1 to 5 m thick coarse-grained sandstone with intraformational conglomerate, disrupted beds, and slumps, Fig. 4c, d, e). Lastly, the chaotic sedimentation gave rise to an olistostrome with m- to km-sized olistoliths composed by Visean or Devonian limestone, and rare Silurian and Ordovician sandstone and lava. The lower part of this turbiditic series yielded late Visean goniatite (Bohm, 1935; Engel et al., 1980-81). Early Serpukhovian (Namurian A) plants have been recovered from turbiditic mudstone (Feist and Galtier, 1985). More recently, corals, foraminifera, and algae indicating a Late

Visean to Early Serpukhovian age for some of the limestone blocks have been documented (Poty et al., 2002; Vachard and Aretz, 2004). Thus in the present state of knowledge, a Serpukhovian age (ca 325 Ma) is inferred for the olistostrome.

From the structural point of view, the Montagne Noire is well known for km-scale, south-verging recumbent folds (Arthaud, 1970). The uppermost recumbent fold, called the Pardailhan nappe, consists of an inverted series of Cambrian, Ordovician and Devonian sedimentary rocks tectonically overlying another inverted series of Ordovician, Devonian, and Carboniferous series, called the Mt-Peyroux nappe. This lower recumbent fold tectonically overlies a series of autochthonous and para-autochthonous tectonic units emplaced within the Late Visean-Serpukhovian foreland basin that can be considered as a flexural basin (Fig. 5). Whatever the detail of this complex fold-and-thrust belt, the mechanism of which remains poorly understood (e.g. Perrin et al., 2013), there is a general agreement to acknowledge both a northern origin of the detritus reworked in the foreland basin, and also a bulk southward direction of the tectonic transport responsible for the emplacement of the recumbent folds and the formation of the flexural basin. Although the root zone of the recumbent folds is not precisely settled, on the basis of stratigraphy and facies correlations, it should be located in the southern part of the Montagne Noire north flank, and partly in the northernmost part of the Axial zone (Arthaud, 1970; Demange, 1993; Alabouvette et al., 2003). It is worth to note that the Axial Zone does not represent a pre-Variscan basement since most of the orthogneiss exposed there are Early Paleozoic granitoids (Roger et al., 2004; Faure et al., 2010). Instead, the Axial Zone was involved in the south-directed tectonics responsible for the recumbent folds (e.g. Alabouvette et al., 2003; Faure et al., 2014, and enclosed references). The metamorphic Axial zone, and the recumbent folds represent the infrastructure and suprastructure of the same stack of nappes, respectively (Fig. 5).

4. Sample description

In this study, samples for detrital zircon analysis come from two parts of the stratigraphic column (Fig 3; Table 1). The basal Devonian (Lochkhovian) black microconglomerate (MO 23, 24) crops out in the northern subunit of the upper recumbent fold (Malviès synform). The overlying white quartzite was sampled in the lower recumbent fold, near the Lower Landeyran bridge (MO 18); and in La Guette, west of Roquebrun (MO 22A).

The analyzed black microconglomerate samples (MO 23, 24) consist essentially of 1mm to 1cm-sized clasts of quartz and subordinate feldspar and lithic elements enclosed in a black matrix (Fig 6d). The quartz gains exhibit deformation microstructures such as undulose extinction, subgrain boundaries, and more rarely dynamic recrystallization with core and mantle structure.

The white quartzite (MO 18, MO 22A) is formed by well rounded quartz grains. Heavy minerals such as zircon, monazite, rutile, and tourmaline can be sometimes observed under the microscope (Fig 6c).

The Late Visean-Serpukhovian terrigenous rocks belong either to the lower recumbent fold (MO 17, 13 FR 52) or to the autochthonous foreland basin (MO 15, MO 16, and MO 26). Whatever their structural position, the analyzed samples are mature sandstone with mm-sized quartz grains. Detrital muscovite is commonly observed (Figs. 6 a, b).

5. LA-ICP-MS zircon U-Pb analytical procedure

Standard heavy liquid and magnetic separation techniques have been used to separate zircons from samples. After handpicking, zircon grains were mounted in epoxy resin and then polished to section the crystals for analysis. Before experiments, all zircons were photographed in both transmitted and reflected light under a microscope, and cathodoluminescence (CL) images were obtained by a CAMECA electron microscope. Based on these photographs, internal structures of zircons have been carefully examined.

Laser ablation ICP-MS zircon U-Pb analyses were conducted on an Agilent 7500a ICP-MS with a 193 nm laser at the MC-ICP-MS laboratory, Institute of Geology and Geophysics, Chinese Academy of Sciences in Beijing. U-Th-Pb ratios and absolute abundances were determined relative to the standard zircon. Detailed analytical procedures are described by Xie et al. (2008). The spot diameter is 44 μm or 60 μm in size. Correction of common lead was applied following the method described by Andersen (2002). The GLITTER program was used for data processing (van Achterbergh et al., 2001). Uncertainties on individual analyses in data tables are reported at a 1σ level. Age diagrams of samples plotted using the Isoplot program (Ludwig, 2003). Zircon ages younger than 1000 Ma are based on $^{206}Pb/^{238}U$ ratios whereas ages older than 1000 Ma are based on $^{207}Pb/^{206}Pb$ ratios. In this study, we excluded zircon age analyses with >10% discordance.

6. Description of the zircon U-Pb analytical results

All analyzed samples, yield zircon detrital grains with a wide range in size from 50 μm to 200 μm (Fig. 7). Except several prismatic, most of the grains have a rounded shape with abraded crystallographic faces indicating important fluvial transportation. Most of the grains exhibit a zonal structure with an inherited core surrounded by recrystallization rims with clear oscillatory zoning. Due to analytic constraints on the beam size, only the large grains have been dated.

6.1. Detrital zircons from the Lower Devonian (Lochkhovian) rocks

Two samples were collected on the basal Devonian (Lochkhovian) black microconglomerate (Fig. 6d) situated in the northern subunit of the upper recumbent fold (also called Pardailhan nappe).

MO 23

Among the 100 analyses on 100 zircon grains, 4 are discordant (Table 2). Except seven zircon grains that yield Th/U ratio lower than 0.1, most analytical results have higher Th/U ratio. Combined with the CL images, these features of the zircons indicate a magmatic origin for these grains (Fig. 7). Most of the zircon ages cluster between 850 Ma and 436 Ma, with several ages older than 1500 Ma.

The diagram shows one pronounced age peak around 450 Ma, and three subordinate peaks around 590 Ma, 620 Ma, and 750 Ma (Fig. 8).

MO 24

Among the 100 analyses conducted on 100 zircons for sample MO24, 98 are concordant within uncertainties (Table 2). All zircons have Th/U ratios varying from 0.10 to 2.37 (Table 2). Similarly with the MO 23 sample, most of the concordant ages range from 850 Ma to 436 Ma, with two dominant peaks at 620 Ma and 450 Ma, and three subordinate peaks around 590 Ma, 620 Ma, and 750 Ma (Fig. 8). Several grains indicate a Paleoproterozoic source around 2000 Ma (Fig. 8).

In this work, two samples of Early Devonian white quartzite were collected in the lower recumbent fold (or Mt-Peyroux nappe). As these rocks consist of well sorted, nearly pure quartz, deposited in a more distal part of the basin than the previous samples (MO23 and MO 24), they will allow us to compare detrital zircons in a sedimentary setting different from that of the microconglomerate.

MO 18

One hundred analyses of 100 zircons were made (Table 2). Among these analyses, 91 are concordant within uncertainties. These ages range from 3249 Ma to 234 Ma. Th/U ratios of all zircons but two are higher than 0.1. Almost all ages vary from 1000 Ma to 416 Ma, with 6 grains older than 1800 Ma (Fig. 8). Two major peaks at 630 Ma and 460 Ma, and two subordinate peaks around 970 Ma and 750 Ma are identified (Fig. 8). It is worth to note that this sample shows a minor difference with the others as five grains (analytical points 25, 51, 65, 68, 72) are younger (such as 234 Ma) than the Early Devonian sedimentary age of the rock, and four grains yield ages comprised between 384 Ma and 332 Ma (Table 2). The CL images of these abnormal grains reveal that analytical spots involved cracks or inclusions, leading to Pb loss and unreliable ages. Thus they have been discarded from the age spectra distribution.

MO 22A

In this sample, 100 zircon grains were selected to conduct 100 analyses and obtain 91 concordant ages. Zircon ages range from 2748 Ma and 435 Ma with 11 zircons older than 1800 Ma, and Th/U ratios vary from 0.04 to 2.90 (Table 2). Except 3 grains, the remaining ones correspond to magmatic zircons. The diagram shows one major group at 1000-435 Ma with two age peaks at 457 Ma and 618 Ma; one subordinate peak around 980 Ma is identified; an unseparated cluster between 795 Ma and 700 Ma is also fixed (Fig. 8). Ages older than 1000 Ma are concentrated around 1980 Ma.

6.2. Detrital zircons from the Carboniferous (Late Visean-Serpukhovian) rocks

Two mature sandstone, with mm-sized quartz grains, were collected on the lower recumbent fold (Fig. 6a)

MO 17

A total of 100 analyses of 100 grains were undertaken and 2 are discordant (Table 3). Ninety-eight zircons yield ages ranging from 2879 Ma to 328 Ma, with Th/U ratios from 0.12 to 1.44, except 3 between 0.02 and 0.06. More than 80% analytical results are situated between 760-330 Ma with four major groups of Phanerozoic ages: 350 Ma, 470 Ma, 580 Ma, and 630 Ma (Fig. 9). In this sample, 14 zircon grains are older than 1500 Ma with a cluster around 2700 Ma.

13 FR 52

One hundred analyses of 100 zircon grains have been conducted, and only 3 zircon ages are discordant (Table 3). All but one zircon (13FR52-02) show magmatic features with Th/U ratio>0.1. The concordant ages range from 2682 Ma to 319 Ma; around 15% analytical result indicated the ages more than 1000 Ma with a small peak around 2100 Ma (Fig. 9). In fact, most of concordant ages range from 680 Ma and 320 Ma with two dominant peaks at 490 Ma and 350 Ma, and two subordinate peaks around 540 Ma and 610 Ma (Fig. 9).

Three mature sandstones were analyzed from the autochthonous foreland basin (Fig. 6b).

MO 15

In this sample, we analyzed 100 spots of 100 zircon grains, among which 6 ages are discordant (Table 3). Except 3 grains, Th/U ratios of all zircons are higher than 0.1. Similar to the 13FR52, 16 zircons are older than 1500 Ma with a cluster around 2100 Ma. Most zircons yield ages range from 670 Ma and 320 Ma with three dominant peaks at 542 Ma, 489 Ma, and 340 Ma (Fig. 9). The youngest zircon age is 315 Ma.

MO 16

Among the 100 analyses on 100 zircon grains, 90 are concordant ages within uncertainties (Table 3). Two grains yield Th/U ratio lower than 0.1. 67 zircons are grouped between 680 Ma and 330 Ma, and a small group at 2150-1800 Ma with two peaks around 1890 Ma and 2140 Ma also exists (Table 3 and Fig. 9). The diagram shows one conspicuous age peak at 452 Ma, and four subordinate peaks at 352 Ma, 504 Ma, 571 Ma, and 616 Ma, respectively (Fig. 9).

MO 26

One hundred spots on 100 zircons were analyzed, and 89 yield concordant ages within uncertainties. Th/U ratios of all zircons but one are higher than 0.1 (Table 3). The concordant ages range from 2966 Ma to 325 Ma; nearly 30% of the analytical result indicated ages older than 1000 Ma, and a cluster at 2060-1940 Ma with a peak around 2053 Ma. This sample contains the largest number of Archean or Proterozoic ages (Table 3 and Fig. 9). In fact, most zircons yield ages <700 Ma with two dominant peaks at 496 Ma and 352 Ma, and two subordinate peaks around 559 Ma and 586 Ma (Fig. 9).

6.3. Synthetic view of inherited zircons

The four Devonian samples yield similar age distribution spectra (Fig. 8). The main peak of inherited grains ranges between 460 and 445 Ma (Ordovician) with a peak around 450 Ma (Fig. 10a). A secondary maximum appears at 628-551 Ma (Cryogenian-Ediacaran) with a peak around 620 Ma (Fig. 10a). Furthermore, several minor secondary peaks represented by a few grains indicate a Paleoproterozoic to Neoproterozoic cluster between 2000 Ma (samples MO 18 and MO 24), 1980 Ma (sample MO 22A and MO 23), and 750 Ma (Fig. 10a). Finally, single isolated grains yield Neoarchean ages (ca 2500 Ma to 3200 Ma) with a small peak around 2700 Ma (sample MO 18; Fig. 10a). It is worth to note that eo-Variscan zircon grains, i.e. slightly younger than 415 Ma, are relatively rare. This can be explained by the fact that analytic spots focus on zircon core rather than rims.

The five Late Visean to Early Serpukhovian sandstone samples exhibit comparable detrital zircon age distribution patterns whatever their structural position whether in the foreland basin or in the recumbent fold (Fig. 11). A significant peak corresponds to Early Carboniferous ages around 352 Ma to 340 Ma (Fig. 9) with a maximum around 350 Ma (Fig. 10b). All these 5 samples even have ages as young as Visean at 340 Ma. The main peak yields Early Paleozoic ages at 490 to 452 Ma with a statistical peak around 485 Ma (Fig. 10b). Three Neoproterozoic peaks around 620 Ma, 580 Ma, and 560 Ma are also represented. On the contrary, Paleoproterozoic ages cluster around 2000 Ma (Fig. 10b). Similar with the analytical results of Devonian samples, single isolated grains yield Neoarchean ages (ca 2500 Ma to 3200 Ma) with a small statistical peak around 2700 Ma (Fig. 10b). Furthermore, Middle Devonian to Silurian ages, i.e. 440 Ma to 380 Ma, are quite rare: 2 grains in sample MO 15, 1 grain in sample MO 16, 2 grains in sample MO 17, and 3 grains in sample MO 26.

Whatever their structural position, all the samples show two significant peaks around 350 Ma and 450 Ma or 480 Ma (Fig. 11). Concerning the Ediacaran ages, the samples (MO 15, MO 16, MO 26) from the foreland basin show a peak around 559 Ma that is shifted to 585 Ma in the recumbent fold (MO 17, 13 Fr 52, Fig. 11). The Paleoproterozoic to Archean zircons recovered from the foreland basin define a significant cluster around 2000 Ma; on the contrary, a small peak around 2700 Ma is shown in the population from the recumbent fold. The difference in the Precambrian age results suggests that the source that supplied the zircons may have changed slightly from the foreland basin to the recumbent fold. Furthermore, it is worth to note that such Precambrian rocks are presently not exposed in the Massif Central.

7. Discussion

The zircon age distribution spectra displayed by the Early Devonian and Late Visean-Serpukhovian terrigenous rocks of the Montagne Noire recumbent folds and foreland basin are similar (Fig. 11). According to the sedimentological data suggest a northern source, i.e. from the already deformed and metamorphosed part of the inner part of the Massif Central. In the following, the possible provenance for the pre-Devonian zircons will be discussed together for Devonian and Carboniferous rocks. Then the case of the Late Devonian to Early Carboniferous zircons will be examined separately.

7.1. Ordovician ages

All the analyzed samples dominantly rework Ordovician zircons ranging between 490 and 445 Ma with statistical peaks around 450 Ma and 480 Ma (Fig. 10). The Ordovician magmatism is well documented in the Variscan belt, where it is interpreted as a consequence of the rifting event that separated several continental stripes, such as Armorica, Mid-German Crystalline Rise, and Avalonia from the northern part of Gondwana (e.g. Matte, 2001; Martínez Catalán et al., 2004, 2009; Faure et al., 2005; Ballèvre et al., 2009). In the French Massif Central, the Ordovician magmatism is mainly represented by alkaline porphyritic granite now transformed into augen orthogneiss. These rocks were probably still buried when the Early Devonian and Carboniferous detritus were deposited in the southern part of the Montagne Noire, however, Ordovician lava and volcanic-sedimentary rocks crop out in the Para-autochthonous Unit, Lower Gneiss Unit and Upper Gneiss Unit (e.g. Pin and Marini, 1993; Alabouvette et al., 2003; Faure et al., 2009). These formations are the most likely potential source rocks that supplied the detrital zircons. A small difference appears between the microconglomerate (MO 23, 24), and the black sandstone (MO 18 and MO 22A) samples. The older has a zircon peak around 450 Ma, and the younger around 460 Ma (Fig. 8). However, given the error bars of the analysis, the difference between these two peaks is not significant. Moreover, the Late Visean-Serpukhovian samples exhibit a prominent statistical peak around 480 Ma (Fig. 9 and 10). The reasons for these differences might be due to a change in the zircon source between the Devonian and the Carboniferous.

7.2. Neoproterozoic-Early Cambrian ages

Most of the samples yield Neoproterozoic ages with population peaks at 620 Ma, 590 Ma and 560 Ma (Figs. 8, 9, and 10), and the early Devonian sedimentary rocks show a smaller peak around 980 Ma, and 750 Ma (Fig. 10). It is often argued that the magmatic rocks emplaced during the Ediacaran Cadomian orogeny (650 - 550 Ma), developed along on the margin of the Gondwana continent, and supplied the late Precambrian zircons. Such a possibility cannot be ruled out (Fig. 12). However, it is worth to note that in contrast to the Massif Armoricain, in the FMC, evidence for an Early Cambrian unconformity supporting a Cadomian orogeny is absent, although Neoproterozoic sedimentary and magmatic rocks do exist in the FMC. Indeed, Neoproterozoic-Cambrian magmatic rocks are recognized in most of the litho-tectonic units of the FMC. For instance, Early Cambrian acidic volcanites, known as "porphyroids" crop out in the Cévennes, Albigeois, Rouergue, Limousin. Also, ca 560 Ma diorite and quartz diorite plutons intrude the grauwacke series belonging to the Lower Gneiss Unit in the Lot series (Fig 1; Pin and Lancelot, 1978), the Cévennes Para-autochthonous Unit (Caron, 1994) or the UGU and LGU in the Rouergue area (Lafon, 1986; Lévêque, 1990). Thus several source rocks for the Tonian-Cryogenian-Edicaran-Early Cambrian detrital zircons can be speculated in the litho-tectonic units exposed north of the Montagne Noire. Presently there are no exposures of 980 Ma, 750 Ma and 620 Ma rocks in the FMC. One possibility is that these zircons were already present in Cambrian or Ordovician detrital rocks that form the host-rocks of the magmatic rocks. In such a case, the primary source for the Neoproterozoic-Early

Cambrian ages would be located in the Gondwana, more to the South than the MCF, and transported to the North by the river drainage network (Fig 12).

7.3. Paleoproterozoic and Neoarchean

In spite of absence of outcrop exposing such old rocks in the FMC, Precambrian inherited zircons are frequently found, but always with a small number of grains, as xenocrysts, in Early Paleozoic magmatic rocks (Cocherie et al., 2005; Lafon, 1986; Alexandrov, 2000; Melleton et al., 2010). A 2000 Ma age cluster is indicated in all the samples (Figs 8, 9). On the contrary, a small peak around 2700 Ma is exhibited in the Late Visean-Serpukhovian samples. Thus, in the Montagne Noire terrigenous rocks, these grains were possibly supplied by the erosion of Early Paleozoic magmatic rocks or sedimentary formations that already contained different Paleoproterozoic and Neoarchean age populations. If those zircons were supplied by the erosion of Neoproterozoic, Cambrian or Ordovician magmatic rocks, the Paleoproterozoic and Neoarchean zircon record is an indirect evidence for a Paleoproterozoic, and even Archean, basement underneath the Variscan belt.

7.4. Late Devonian to Early Carboniferous

The Late Visean-Serpukhovian turbidite yields also Famennian-Tournaisian detrital zircons. Metamorphic and magmatic rocks of this age are well known in the Lower Gneiss Unit. Biotite-garnet-staurolite gneiss are well developed in the Lower Gneiss Unit where they yield monazite U-Th-Pb ages around 365-350 Ma (Melleton et al., 2009; Do Couto et al., 2015), but metamorphic zircon ages have not been measured in these rocks. 355-350 Ma magmatic rocks, well exposed in the NW part of the FMC, correspond to the emplacement age of the biotite ± cordierite Guéret granite (Fig 1; Cartannaz et al., 2007). These rocks are suitable sources for the Montagne Noire detrital zircons since they were already exhumed in Tournaisian-Early Visean, as documented by the fossiliferous sandstone and limestone series that overlies the Guéret massif (Mamet et al., 1970). Furthermore, mafic and felsic rocks belonging to the Brévenne ophiolitic series of Eastern Massif Central yielding ca 366±5 Ma ages are also possible source rocks (Fig. 1; Pin and Paquette, 1998).

Lastly, 345 to 335 Ma (Early and Middle Visean) magmatic rocks crop out in the NE part of the FMC, namely Montagne Bourbonnaise and Morvan areas (Fig. 1). There, several sedimentary and volcanic series dated of Tournaisian, Early and Middle Devonian by foraminifera and corals in limestone, and plants debris in terrigenous formations, are covered by the Late Visean "Tufs Anthracifères" (Peyrel and Didier, 1983; Duthou et al., 1984; Leistel and Gagny, 1984; Binon and Pin, 1989; Delfour, 1989; Pin and Duthou, 1990; Pin, 1991; Leloix et al., 1999; Faure et al., 2002; Fig 13). The various volcanic rocks, such as rhyolite, dacite, trachyte, and basaltic lava flows, pyroclastites, volcanic breccias and grauwackes are potential sources for the detrital zircons recovered in the Montagne Noire turbidite.

The NE Massif Central and Montagne Noire are presently separated by ca 250 km where Tournaisan-Visean rocks are presently lacking. However such a rocks might have been exposed there and eroded to supply the material recovered in the Montagne Noire foreland basin. Contemporaneous plutonic rocks are also reported in the Montagne Bourbonnaise (Fig. 13), particularly the biotite-K-feldspar (±hornblende) Bois Noirs and Mayet-de-Montagne massifs dated at 328±6, and 328±4 Ma, respectively (Binon and Pin, 1989). Nevertheless, it is not settled yet if plutons contemporaneous to these ones were already exposed in Late Visean.

Furthermore, the eo-Variscan rocks, either HP/LT metamorphic rocks or HT/LP gneiss and migmatites with ages ranging from 440 to 400 Ma, and 385-375 Ma, respectively are rare in the sedimentary record, both in Early Devonian and Carboniferous terrigenous rocks. A possible interpretation of this phenomenon is that the eo-Variscan deep seated metamorphic rocks were not already exposed to the surface in the Devonian or Late Variscan to Early Serpukhovian. Moreover, this scarcity may also result of selective sampling of the analyzed grains as large magmatic zircons were preferentially chosen instead of the small metamorphic rims. In a future work, detail analyses should be done to investigate the recrystallization rims around zircon in order to reveal the eo-Variscan magmatic and metamorphic events.

On the basis on our results, a Visean reconstruction of the paleotopography of the Massif Central, showing the possible sources and drainage patterns, is proposed in Fig. 14. Moreover, as discussed above, it must not be forgotten that a part of the detrital zircon grains enclosed in the Devonian and Carboniferous sandstones may have experienced multiple reworking and recycling, as already documented for the magmatic rocks (Alexandrov, 2000; Cocherie et al., 2005; Ducassou et al., 2014; Faure et al., 2010; Melleton et al., 2010). Thus, the search for a source to the North of the Massif Central is not the only possibility. Particularly, the Proterozoic and Archean grains might have been eroded and deposited several times in the Early Paleozoic sedimentary rocks or scavenged by the magmas before their final depositions.

8. Conclusion

This first study of the detrital zircons deposited in the Early Devonian and the Visean-Serpukhovian detrital rocks of the Montagne Noire area shows that a wide range of detrital zircons were supplied from the northern inner part of the Variscan belt of the FMC. The zircon grains from all of the samples yielded U-Pb age spectra ranging from Neoarchean to Late Paleozoic with several age population peaks at 2700 Ma, 2000 Ma, 980 Ma, 750 Ma, 620 Ma, 590 Ma, 560 Ma, 480 Ma, 450 Ma, and 350 Ma. The Precambrian grains recorded more complex itinerary and may be experienced a multi-recycling history. The Ordovician magmatism (around 450 Ma) appears as the main component of detrital zircons.

The subordinate ages of detrital zircons were 352-340 Ma with a statistical peak around 350 Ma in the Late Visean-Early Serpukhovian turbidite complies with the Tournaisian Guéret type granites emplaced at the end of the main Variscan phase, and exhumed in Early Carboniferous. Since Tournaisian magmatic rocks crop out only in the northern part of the FMC, this result complies with the previous conclusion inferred from sedimentological studies that the drainage pattern was southward directed (Fig. 14). Concerning the provenance of the Early to Middle Visean detritus, a northern source is also inferred on the basis of sedimentology. Presently, magmatic rocks of this age crop out only in the Montagne Bourbonnaise-Morvan area, ca 250 km to the North of the deposition area, suggesting also a south-directed drainage towards the Late Visean-Serpukhovian Variscan foreland basin. Nevertheless, a presently eroded, closer source cannot be ruled out.

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Figure Captions

Fig. 1. Structural map of the Variscan French Massif Central (modified from Faure et al., 2009).

Fig. 2. Structural map of the Montagne Noire with location of the dated detrital zircons samples.

Fig. 3. Lithostratigraphic log of the Paleozoic series cropping out in the Montagne Noire (modified from Arthaud, 1970; Alvaro and Vizcaïno, 1998; and Vizcaïno and Alvaro, 2001).

Fig. 4. Field picture of Devonian quartzite and Carboniferous turbidite. (a). Devonian unconformity overlying Early Ordovician sandstone (due to the Carboniferous tectonics, the unconformity is upside down); (b). Early Devonian massive white quartzite (Mur quartzeux), sample MO 18; (c).Visean-Serpukhovian turbidite with intraformational matrix-supported conglomerate; (d). General view of the Visean-Serpukhovian turbidite; (e). Close-up of D showing intraformational conglomerate with white quartz, radiolarian chert, and black siltite clasts (sample MO 17).

Fig. 5. Schematic cross section of Montagne Noire with sample location; italics: Devonian sandstone, plain: Visean-Serpukhovian sandstone. (Modified from Faure et al., 2014).

Fig. 6. Microscope thin sections representative of dated rocks. Late Visean-Serpukhovian rocks, (a). Fine grained sandstone (13FR 52), (b). Coarse grained sandstone (MO 15) with detrital muscovite. Early Devonian rocks, (c). White quartzite with detrital zircon (MO 18), (d). Black microconglomerate (MO 24).

Fig. 7. Representative cathodoluminescence (CL) images of selected detrital zircons with a wide range in size and morphology. Most of the analyzed grains exhibit an inherited core surrounded by several recrystallization rims. The circles represent U-Pb analytical sites; Analytical numbers and ages presented below; the scale length is 100 μm.

Fig. 8. Cumulative probability plots of detrital zircon U-Pb ages in Early Devonian sandstone, see Figs 2 and 5, and Table 1 for location.

Fig. 9. Cumulative probability plots of detrital zircon U-Pb ages in Late Visean-Early Serpukhovian sandstone, see Figs 2 and 5, and Table 1 for location.

Fig. 10 Synthetic and comparison of the cumulative probability plots of detrital zircon U-Pb ages from the (a). Early Devonian sandstone, (b). Late Visean-Early Serpukhovian sandstone, and (c). Histograms of all the concordant detrital zircon ages obtained in this study.

Fig. 11. Synthetic cumulative probability plots of detrital zircon U-Pb ages from the Carboniferous autochthonous foreland basin and the Carboniferous and Devonian from the recumbent folds.

Fig. 12. Schematic paleogeographic map of the main continents at 550 Ma - 490 Ma showing the situation of the French Massif Central (FMC) in the northern margin of Gondwana, and the Avalonia, Mid-German Crystalline Rise (MGCR) and Armorica microcontinents separated from Gondwana in Early Ordovician. Arrows indicate the possible source areas for the detrital zircons. In the Neoproterozoic-Early Cambrian, both northern (from the Cadomian belt), and southern (from the West African craton) sources are possible. In Ordovician, due to the rifting, only a southern (i.e.

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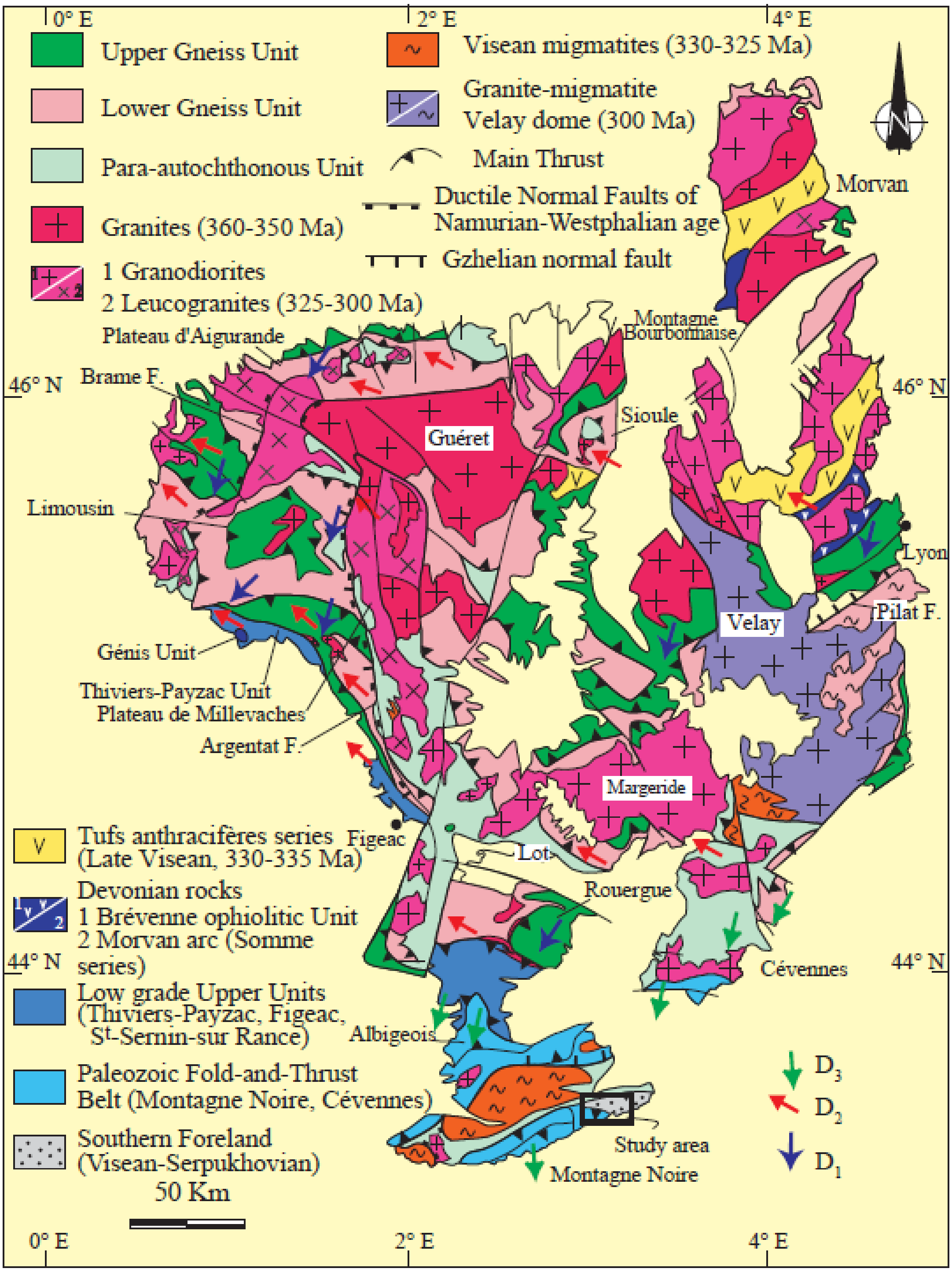
Fig. 13. Schematic geological map and lithostratigraphic logs of Devonian-Visean series recognized in NE Massif Central (modified from Leistel and Gagny, 1984; Binon and Pin, 1989; Delfour, 1989; Leloix et al., 1999). Ages of Visean plutons are from Binon and Pin (1989) for zircon ages, and A. Cocherie (personal communication) for monazite. Zr: zircon, mz: monazite. In the map, due to their limited extension, the middle Visean series (V2) have been grouped with the early Visean (V1) ones. The late Visean (V3) "Tufs Anthracifères" series unconformably covers all previous series.

Fig. 14. Schematic topographic reconstruction of the French Massif Central during the Visean and the possible sources for the detrital zircons of the Foreland basin.

Table 1. Summary of samples from the foreland basin of the Variscan Southern Massif Central in Montagne Noire

Table 2. Analytical data for the dated Devonian zircons: MO 18, MO 22A, MO 23, MO 24.

Table 3. Analytical data for the dated Carboniferous zircons: 13 FR 52, MO 15, MO 16, MO 17, MO 26.



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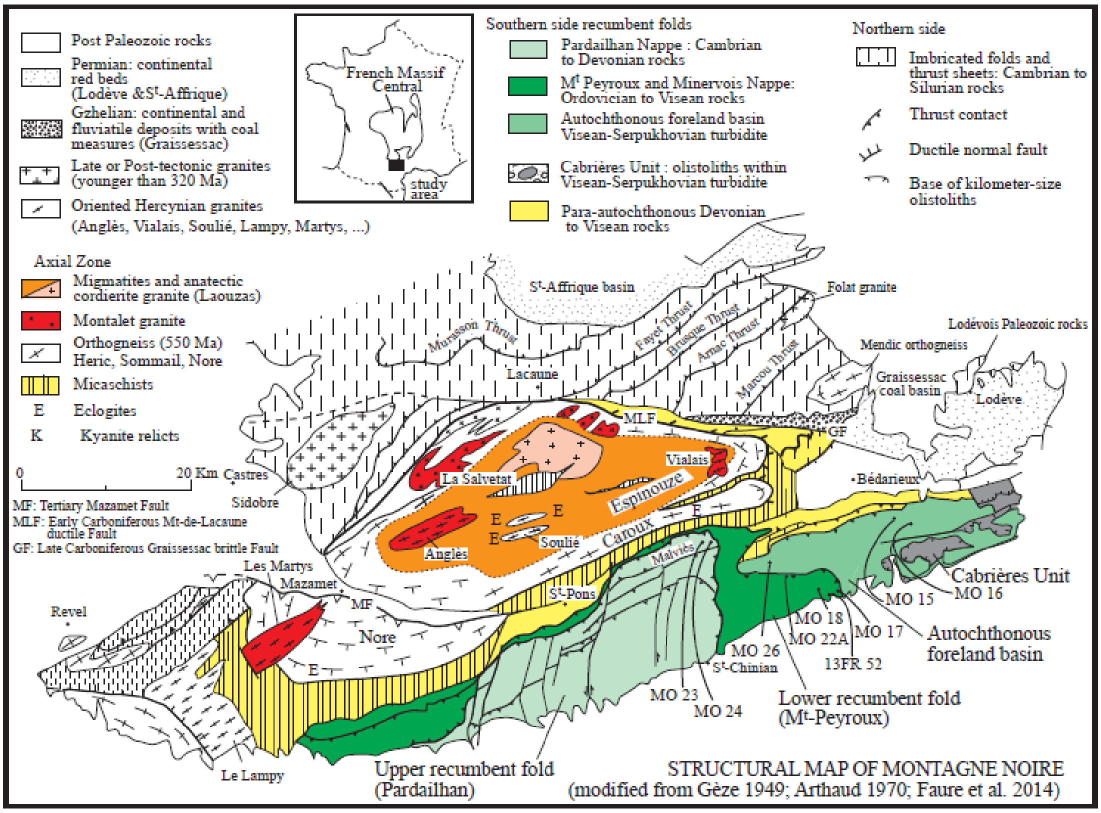

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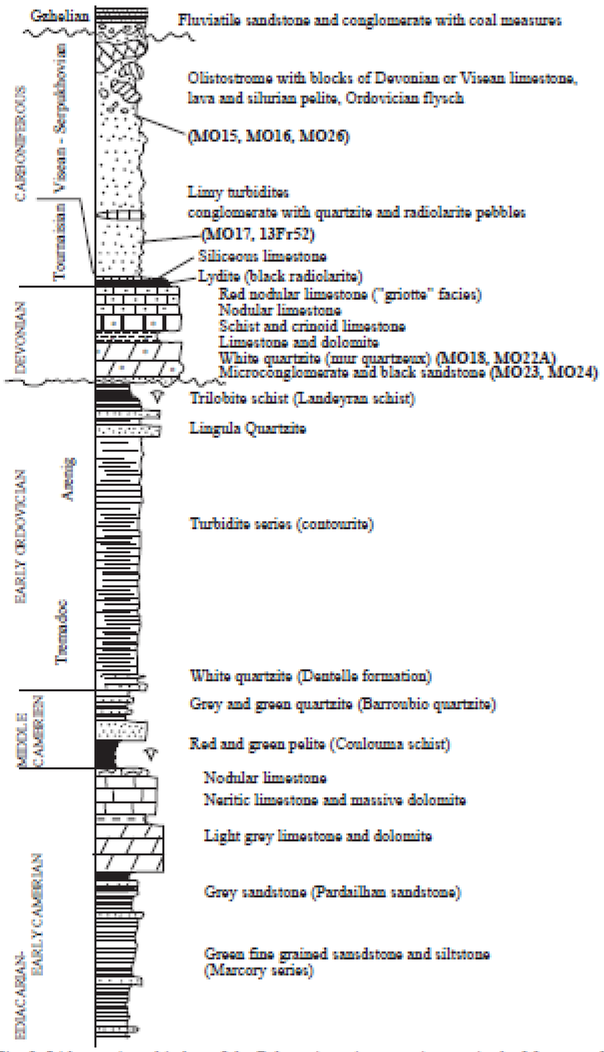

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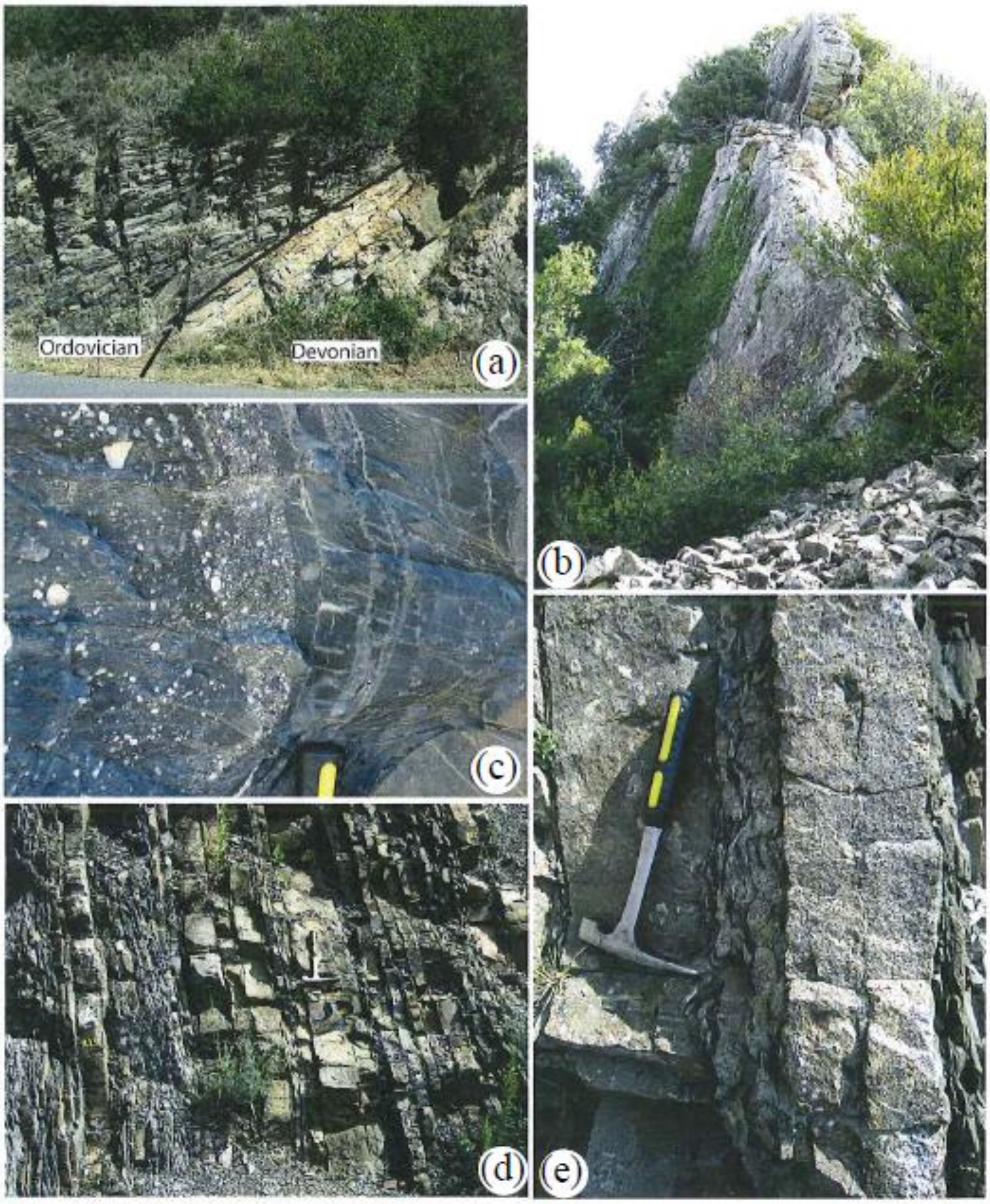

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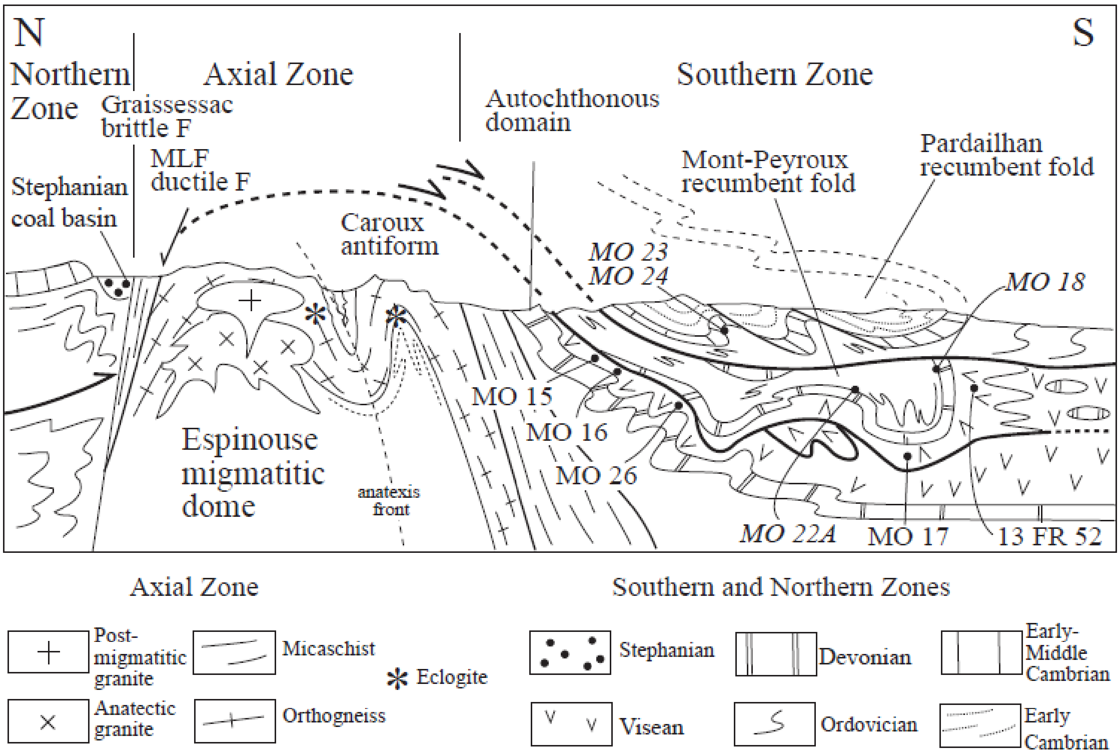

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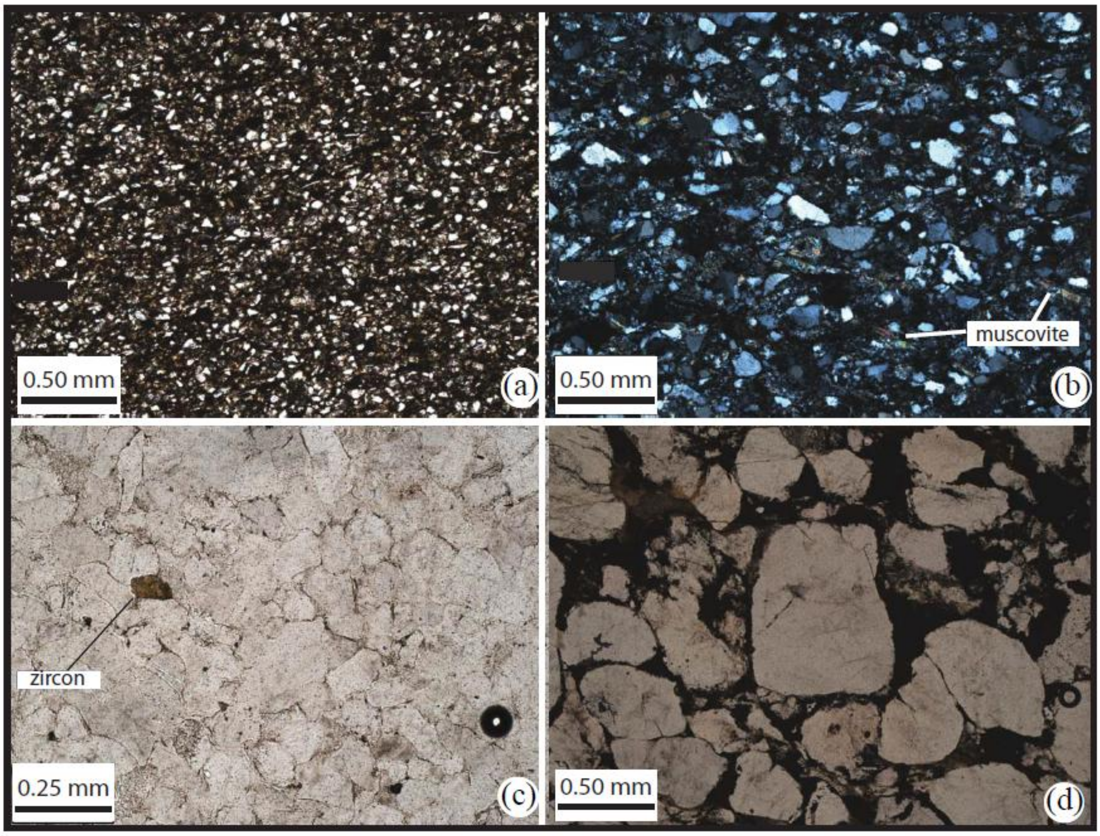

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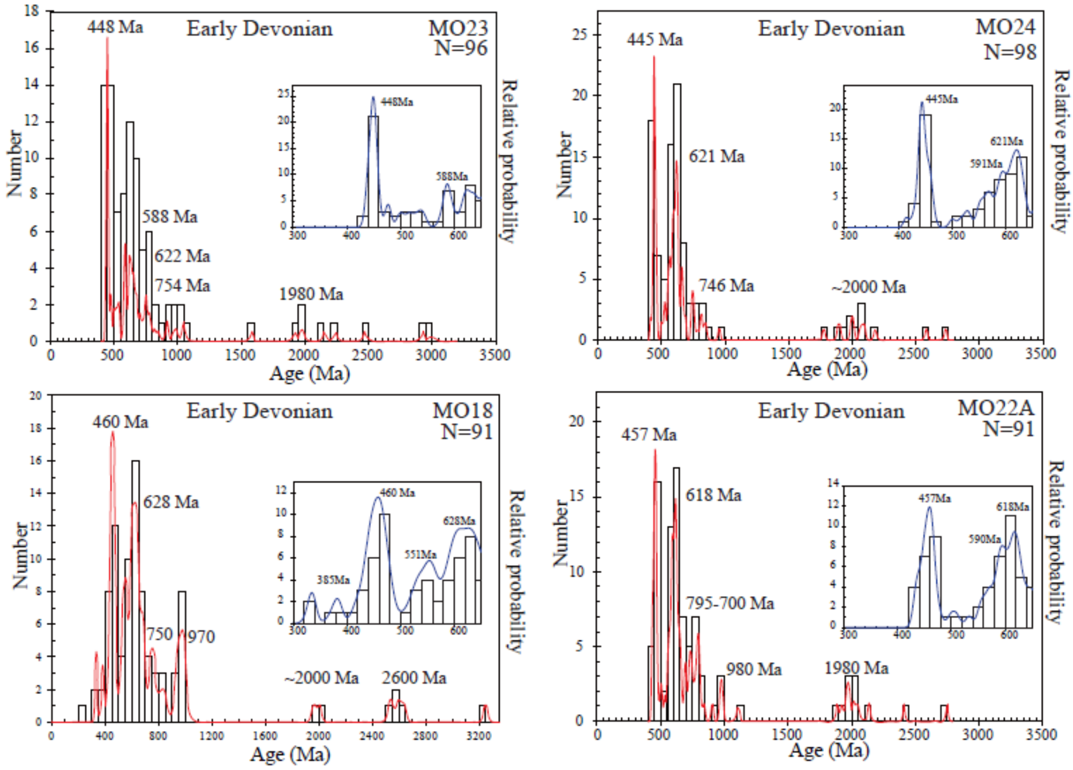

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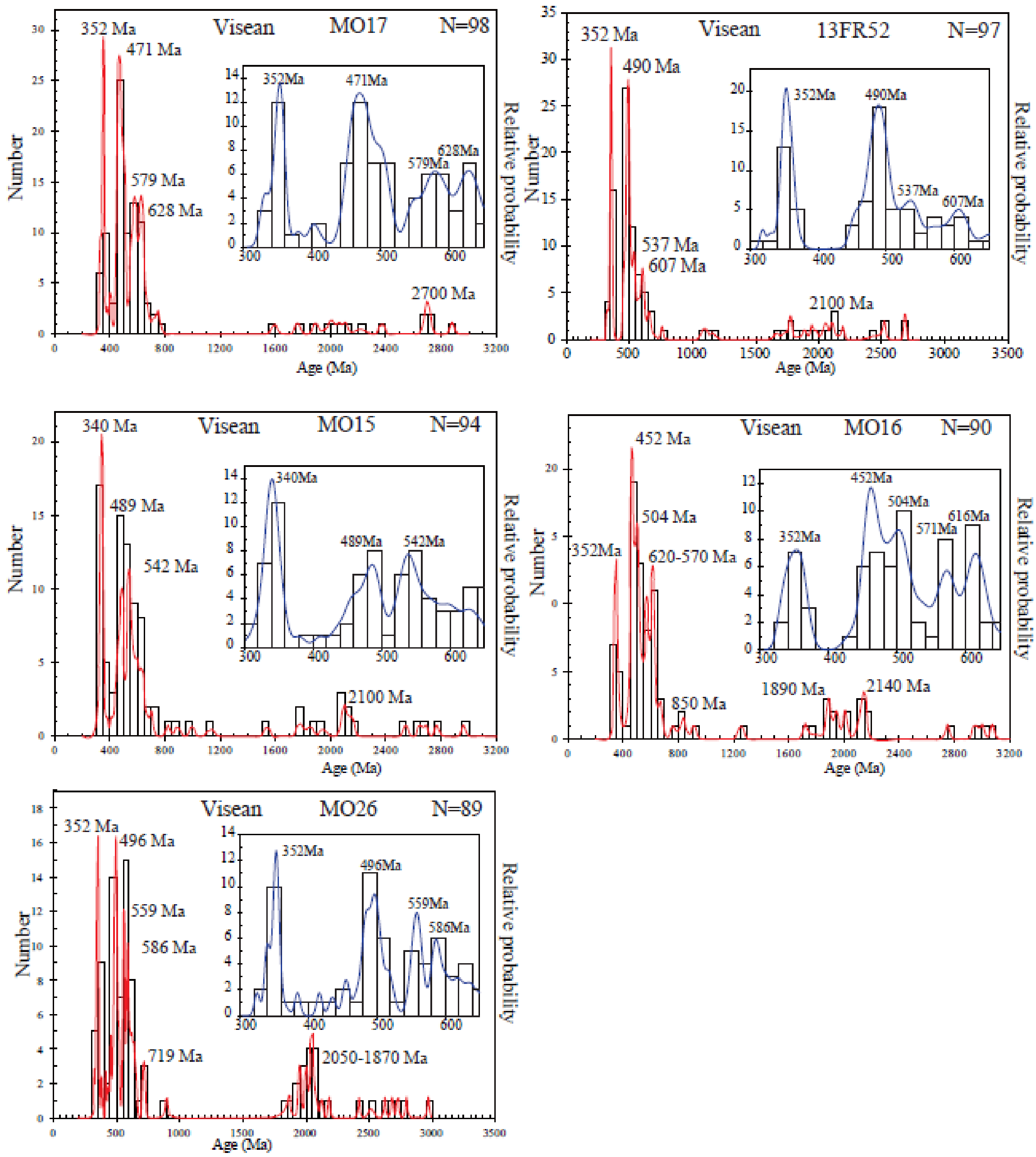

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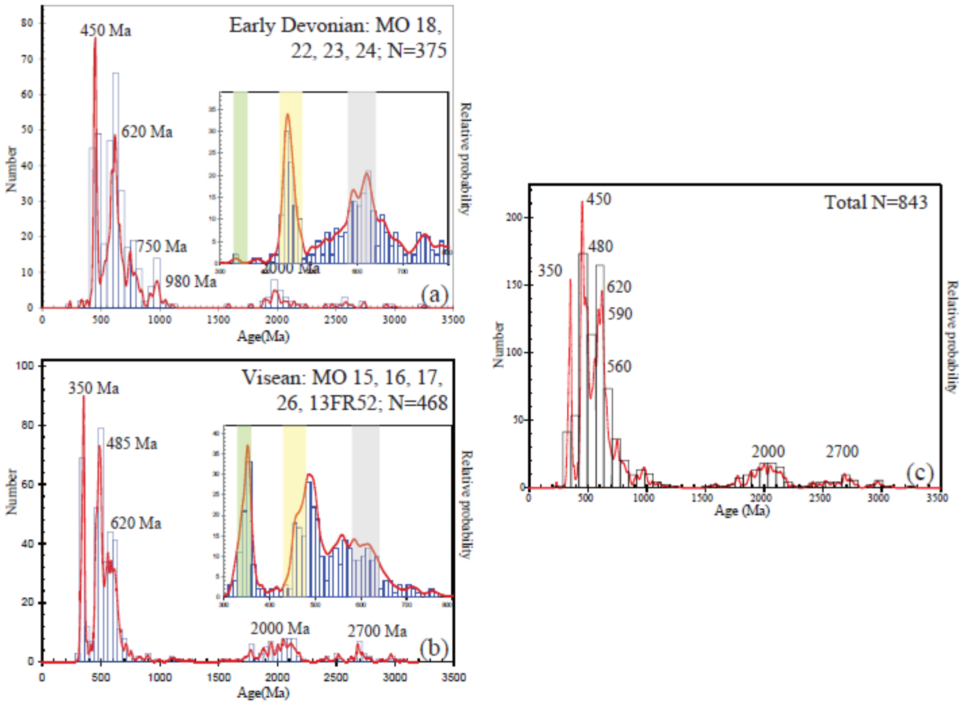

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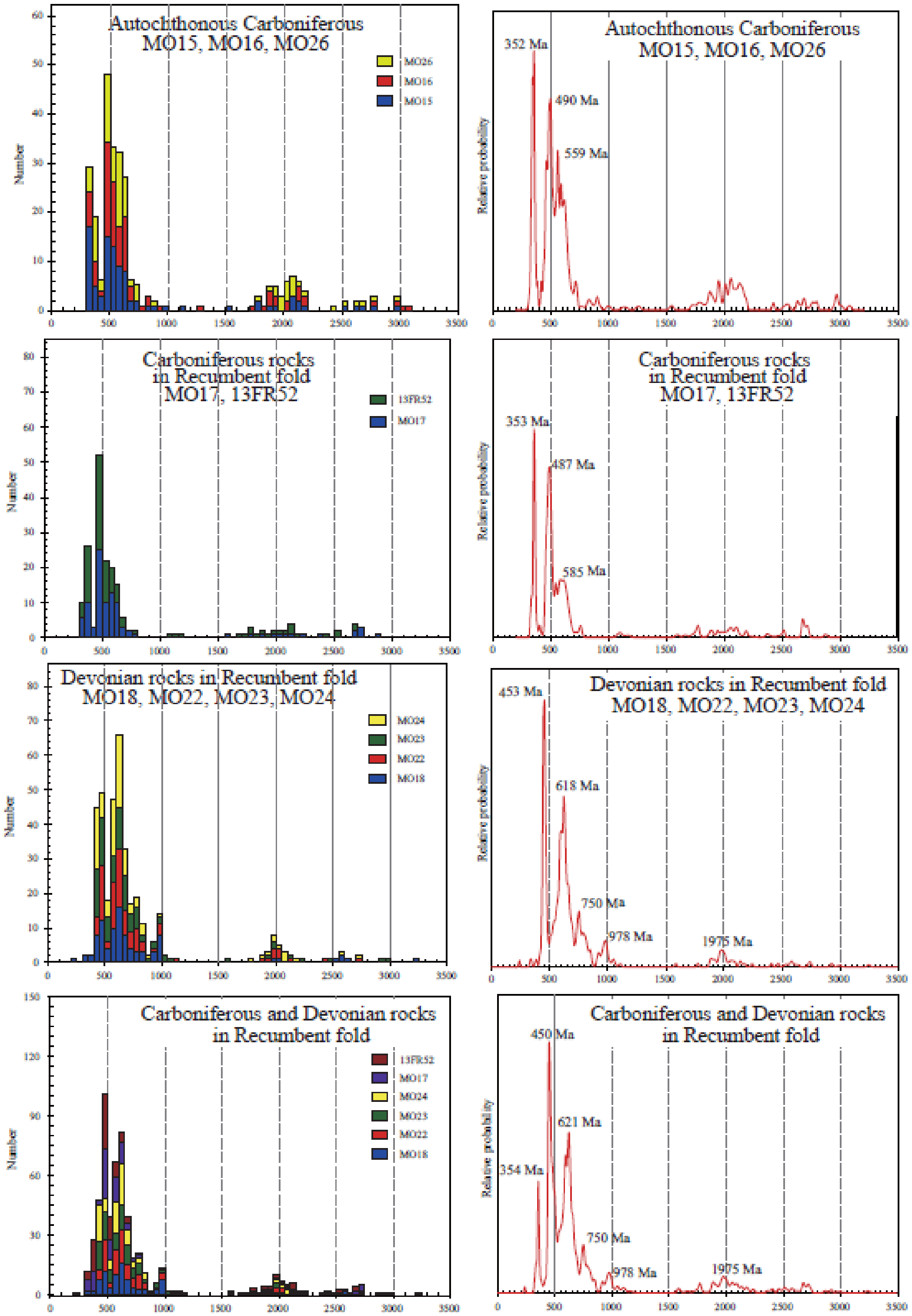

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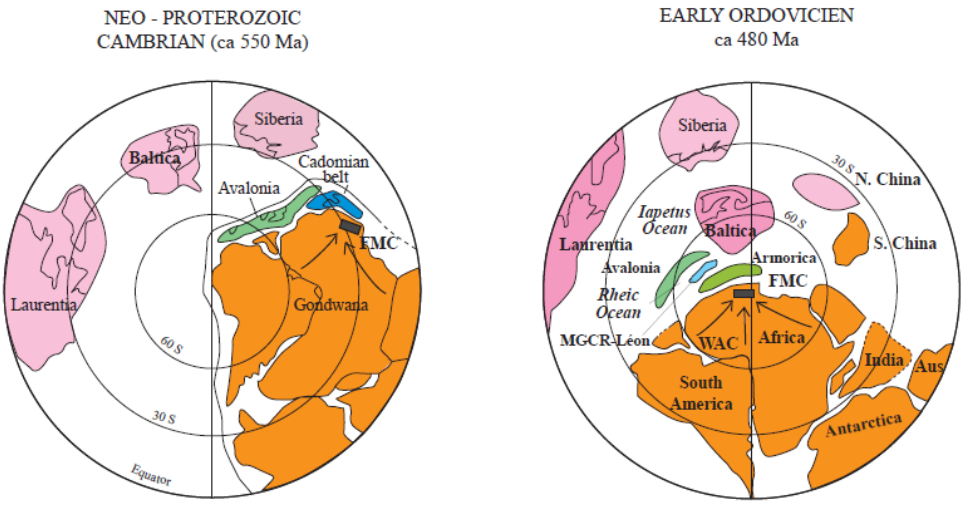

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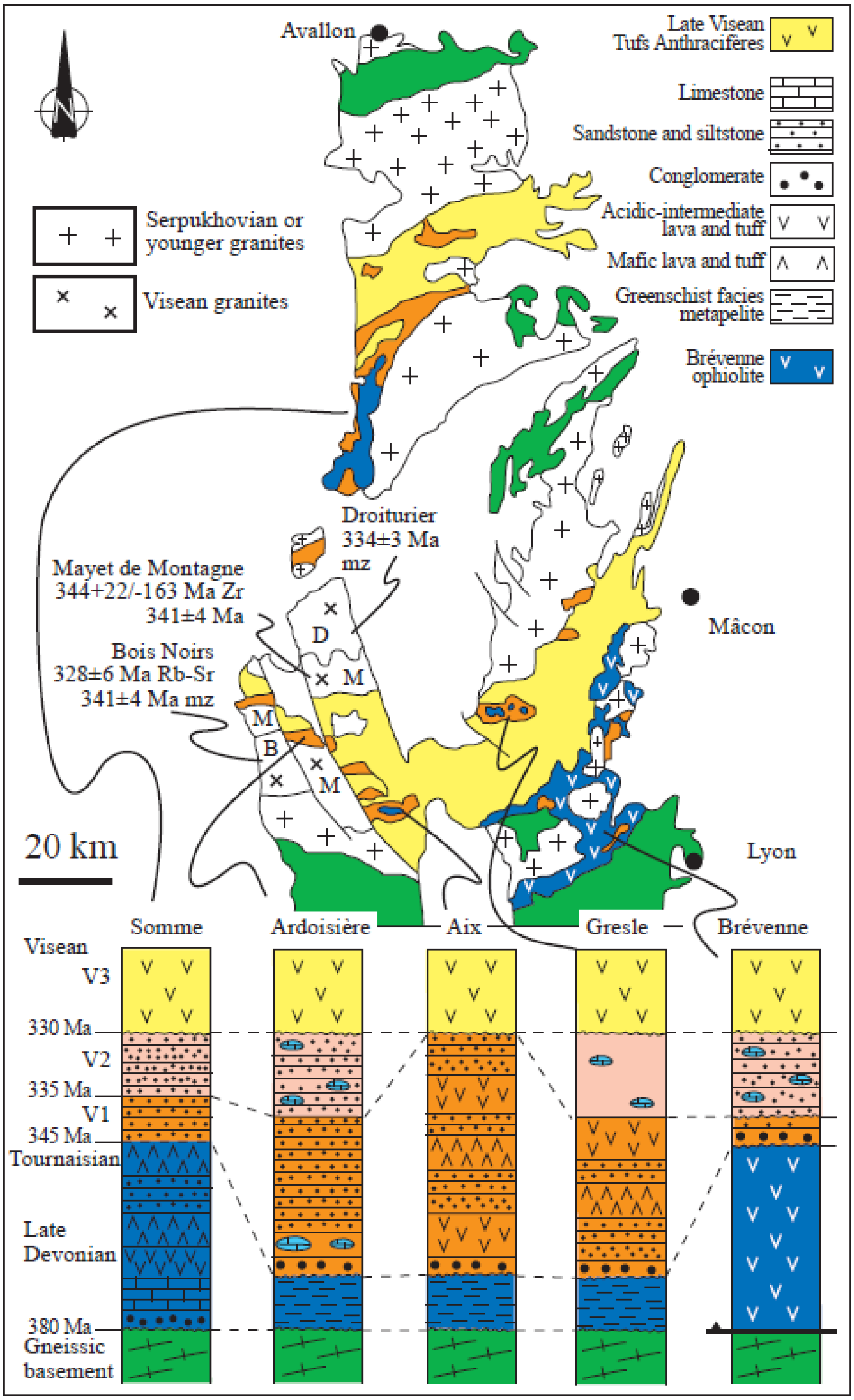

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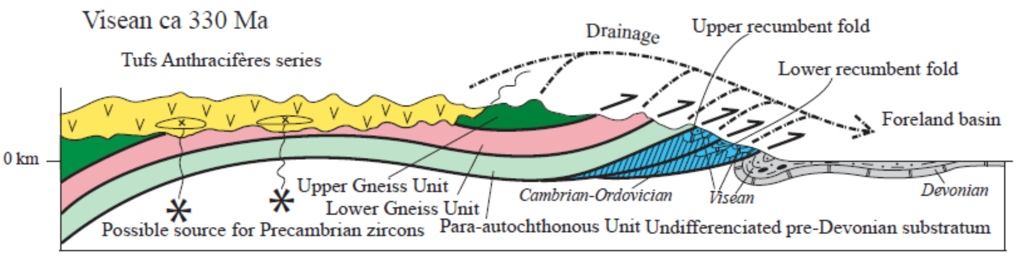

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Table 1 Summary of samples from the foreland basin of the Variscan Southern Massif Central in Montagne Noire				
Stratigraphic Age	Sample n°	GPS location	Petrography	Tectonic position
Serpukhovian	MO 15	43° 32' 24.41"	Sandstone	Autochthonous
	Cabrerolles	03° 07' 47.30"		
	MO16	43° 31' 55.33"	Sandstone	Autochthonous
to	Lenthéric	03° 08' 58.50"		
	MO 26	43° 31' 38.54"	Sandstone	Autochthonous
	Roquebrun	03° 02' 19.52"		
Visean	MO 17	43° 29' 54.72"	Microconglomerate	Lower recumbent fold
	Barrac	03° 06' 57.02"		(Mt-Peyroux)
	13 FR 52	43° 28' 37.18"	Sandstone	Lower recumbent fold
	Landeyran	03° 04' 03.63"		(Mt-Peyroux)
Devonian	MO 18	43° 28' 56.58"	Quartzite	Lower recumbent fold
	Landeyran	03° 03' 51.42"		(Mt-Peyroux)
	MO 22A	43° 29' 58.8"	Quartzite	Lower recumbent fold
	Roquebrun	03° 02' 56.4"		(Mt-Peyroux)
	MO 23	43° 32' 31.70"	Microconglomerate	Upper recumbent fold
	Malviès	02° 55' 50.03"		(Pardailhan)
	MO 24	43°32' 43.58"	Microconglomerate	Upper recumbent fold
	Fenouillède	02° 56' 24.13"		(Pardailhan)

Table 2. Analytical data for the dated Devonian zircons: MO 18, MO 22A, MO 23, MO 24.

Spot No.	Th (ppm)	U (ppm)	Th/U	Ratios							Ages (Ma)							Discordance (%)	Best Ages	±1σ
				207Pb/206Pb	±1σ	207Pb/235U	±1σ	206Pb/238U	±1σ		207Pb/206Pb	±1σ	207Pb/235U	±1σ	206Pb/238U	±1σ				
MO18-01	88	311	0.28	0.06135	0.00134	0.09833	0.00192	0.83218	0.01665		652	19	605	11	615	9		1.65%	605	11
MO18-02	123	229	0.54	0.07501	0.00206	0.08036	0.00172	0.83144	0.02054		875	120	494	11	568	23		14.98%		
MO18-03	136	361	0.38	0.06669	0.00128	0.12615	0.00240	1.16056	0.02024		724	85	763	14	753	18		-1.31%	763	14
MO18-04	97	98	0.99	0.07417	0.00212	0.16291	0.00365	1.66666	0.04363		1046	24	973	20	996	17		2.36%	973	20
MO18-05	41	114	0.36	0.05830	0.00270	0.07652	0.00200	0.61538	0.02626		541	50	475	12	487	17		2.53%	475	12
MO18-06	102	163	0.62	0.06259	0.00199	0.09094	0.00201	0.78516	0.02294		694	29	561	12	588	13		4.81%	561	12
MO18-07	127	397	0.32	0.05942	0.00127	0.09600	0.00185	0.78690	0.01534		583	19	591	11	589	9		-0.34%	591	11
MO18-08	122	189	0.65	0.06256	0.00166	0.10435	0.00218	0.90048	0.02190		693	23	640	13	652	12		1.88%	640	13
MO18-09	64	192	0.33	0.05551	0.00195	0.07224	0.00163	0.55312	0.01790		433	35	450	10	447	12		-0.67%	450	10
MO18-10	57	203	0.28	0.05976	0.00184	0.07564	0.00164	0.62353	0.01760		595	28	470	10	492	11		4.68%	470	10
MO18-	13	41	0.32	0.07196	0.0047	0.09045	0.0031	0.89772	0.0538		641	239	551	18	569	44		3.27%	551	18

11					0		0		4											
MO18-12	132	196	0.68	0.06253	0.00175	0.10179	0.00215	0.87787	0.02247		692	25	625	13	640	12		2.40%	625	13
MO18-13	46	164	0.28	0.06480	0.00178	0.11280	0.00240	1.00818	0.02538		768	24	689	14	708	13		2.76%	689	14
MO18-14	82	115	0.71	0.06964	0.00209	0.13501	0.00301	1.29685	0.03563		918	26	816	17	844	16		3.43%	816	17
MO18-15	67	90	0.74	0.07196	0.00211	0.17066	0.00383	1.69400	0.04560		985	25	1016	21	1006	17		-3.05%	985	25
MO18-16	91	126	0.72	0.06275	0.00212	0.10396	0.00237	0.89983	0.02797		700	32	638	14	652	15		2.19%	638	14
MO18-17	66	346	0.19	0.06182	0.00145	0.08966	0.00179	0.76447	0.01638		516	86	551	11	544	14		-1.27%	551	11
MO18-18	89	181	0.49	0.05810	0.00195	0.07124	0.00159	0.57093	0.01766		534	33	444	10	459	11		3.38%	444	10
MO18-19	20	65	0.30	0.06096	0.00280	0.10098	0.00271	0.84898	0.03587		638	47	620	16	624	20		0.65%	620	16
MO18-20	249	518	0.48	0.06790	0.00125	0.09842	0.00186	0.92173	0.01535		866	17	605	11	663	8		9.59%	605	11
MO18-21	19	46	0.41	0.06692	0.00344	0.12895	0.00369	1.19005	0.05689		835	54	782	21	796	26		1.79%	782	21
MO18-22	28	54	0.53	0.07168	0.00323	0.10498	0.00291	1.03782	0.04253		977	42	644	17	723	21		12.27%		
MO18-23	146	159	0.92	0.07909	0.00213	0.10378	0.00224	1.13202	0.02752		820	161	627	14	670	35		6.86%	627	14
MO18-24	57	121	0.47	0.05604	0.00237	0.07314	0.00182	0.56531	0.02199		454	45	455	11	455	14		0.00%	455	11
M	9	6	0.	0.06	0.	0.0	0.	0.3	0.		293	1	234	5	239	8		2.1	2	5

O18-25	0	90	13	744	00159	3768	00076	5045	00744			00						4%	34	
MO18-26	91	143	0.64	0.08902	0.00254	0.10904	0.00247	1.33873	0.03419		781	160	648	15	678	34		4.63%	648	15
MO18-27	179	305	0.59	0.05580	0.00153	0.07399	0.00153	0.56942	0.01437		444	25	460	9	458	9		-0.43%	460	9
MO18-28	72	247	0.29	0.06614	0.00158	0.09052	0.00183	0.82571	0.01795		537	100	553	11	550	17		-0.54%	553	11
MO18-29	173	208	0.83	0.06522	0.00167	0.10727	0.00223	0.96488	0.02261		781	22	657	13	686	12		4.41%	657	13
MO18-30	129	559	0.23	0.06566	0.00238	0.05297	0.00125	0.47965	0.01579		796	33	333	8	398	11		19.52%		
MO18-31	203	262	0.78	0.06207	0.00140	0.11189	0.00223	0.95786	0.01981		677	20	684	13	682	10		-0.29%	684	13
MO18-32	281	232	1.21	0.05910	0.00157	0.09816	0.00203	0.80003	0.01950		571	24	604	12	597	11		-1.16%	604	12
MO18-33	57	49	1.17	0.17844	0.00320	0.50165	0.01098	12.34495	0.21045		2638	17	2621	47	2631	16		0.65%	2638	17
MO18-34	83	83	1.00	0.07439	0.00227	0.16399	0.00377	1.68230	0.04717		1052	26	979	21	1002	18		2.35%	979	21
MO18-35	106	192	0.55	0.06292	0.00167	0.12652	0.00266	1.09781	0.02682		706	23	768	15	752	13		-2.08%	768	15
MO18-36	123	95	1.29	0.05769	0.00255	0.09608	0.00246	0.76438	0.03137		518	48	591	14	577	18		-2.37%	591	14
MO18-37	73	91	0.81	0.12331	0.00213	0.35858	0.00728	6.09772	0.09754		2005	17	1975	35	1990	14		1.52%	2005	17
MO18-	109	144	0.76	0.08152	0.0026	0.09377	0.0022	1.05424	0.0306		678	186	564	14	587	36		4.08%	564	14

38					4		0		8											
MO18-39	151	903	0.17	0.19693	0.004855	0.03155	0.00073	0.85685	0.016661		1545	146	173	5	312	19		80.35%		
MO18-40	79	109	0.73	0.06008	0.002233	0.09772	0.002333	0.80962	0.027768		606	36	601	14	602	16		0.17%	601	14
MO18-41	109	109	1.01	0.12042	0.002100	0.35149	0.00715	5.83640	0.094431		1962	17	1942	34	1952	14		1.03%	1962	17
MO18-42	126	524	0.24	0.06885	0.001422	0.07559	0.001447	0.71762	0.013339		567	87	464	9	482	13		3.88%	464	9
MO18-43	48	173	0.28	0.07474	0.002377	0.07787	0.001799	0.80249	0.022290		491	142	473	11	476	22		0.63%	473	11
MO18-44	103	330	0.31	0.05649	0.001611	0.07203	0.001522	0.56106	0.014666		472	26	448	9	452	10		0.89%	448	9
MO18-45	19	31	0.61	0.06122	0.004599	0.12009	0.004220	1.01375	0.071170		647	93	731	24	711	36		-2.74%	731	24
MO18-46	86	162	0.53	0.07695	0.001778	0.16647	0.003447	1.76634	0.037225		1120	19	993	19	1033	14		4.03%	993	19
MO18-47	150	316	0.47	0.05471	0.001445	0.07401	0.001522	0.55836	0.013365		400	25	460	9	450	9		-2.17%	460	9
MO18-48	72	130	0.55	0.07242	0.002133	0.17172	0.003394	1.71486	0.046631		998	25	1022	22	1014	17		-2.35%	998	25
MO18-49	82	146	0.56	0.07600	0.002511	0.10136	0.002377	1.06221	0.031855		1095	28	622	14	735	16		18.17%		
MO18-50	138	141	0.98	0.06214	0.002222	0.10403	0.002455	0.89135	0.029355		679	34	638	14	647	16		1.41%	638	14
MO18-51	23	361	0.06	0.05937	0.001911	0.05367	0.001119	0.43940	0.012990		453	93	336	7	351	10		4.46%	336	7
M	1	8	1.	0.05	0.	0.1	0.	0.8	0.		600	4	662	1	648	1		-	6	1

O18-52	03	5	20	991	00259	0810	00281	9301	03563			4		6		9		2.11%	62	6
MO18-53	89	231	0.39	0.06300	0.00203	0.07405	0.00167	0.64330	0.01887		708	29	461	10	504	12		9.33%	461	10
MO18-54	84	256	0.33	0.05749	0.00171	0.08588	0.00185	0.68082	0.01867		510	28	531	11	527	11		-0.75%	531	11
MO18-55	124	121	1.03	0.07210	0.00201	0.15933	0.00353	1.58383	0.04055		989	23	953	20	964	16		1.15%	953	20
MO18-56	91	237	0.38	0.06646	0.00310	0.07675	0.00212	0.70328	0.02989		624	179	473	13	500	30		5.71%	473	13
MO18-57	77	133	0.58	0.04974	0.00646	0.07619	0.00394	0.52251	0.06400		183	180	473	24	427	43		-9.73%	473	24
MO18-58	97	189	0.51	0.06120	0.00195	0.10638	0.00237	0.89760	0.02636		646	30	652	14	650	14		-0.31%	652	14
MO18-59	57	353	0.16	0.06607	0.00150	0.12250	0.00247	1.11593	0.02330		809	20	745	14	761	11		2.15%	745	14
MO18-60	43	184	0.23	0.05896	0.00193	0.10368	0.00233	0.84280	0.02550		566	31	636	14	621	14		-2.36%	636	14
MO18-61	66	210	0.31	0.05809	0.00196	0.07208	0.00164	0.57721	0.01784		533	32	449	10	463	11		3.12%	449	10
MO18-62	33	78	0.42	0.06003	0.00437	0.14035	0.00455	1.16161	0.08060		605	95	847	26	783	38		-7.56%	847	26
MO18-63	154	229	0.67	0.05658	0.00271	0.09473	0.00244	0.73899	0.03319		475	55	583	14	562	19		-3.60%	583	14
MO18-64	25	15	1.59	0.05785	0.01228	0.12246	0.00896	0.97656	0.19896		524	322	745	51	692	102		-7.11%	745	51
MO18-	44	188	0.24	0.05875	0.0034	0.06008	0.0017	0.48663	0.0264		558	69	376	11	403	18		7.18%	376	11

65					3		6		2											
MO18-66	22	402	0.05	0.06368	0.00177	0.11231	0.00240	0.98599	0.02515		731	24	686	14	697	13		1.60%	686	14
MO18-67	105	210	0.50	0.05814	0.00174	0.06865	0.00147	0.55017	0.01517		535	28	428	9	445	10		3.97%	428	9
MO18-68	43	335	0.13	0.05746	0.00153	0.06145	0.00127	0.48679	0.01187		509	24	384	8	403	8		4.95%	384	8
MO18-69	168	173	0.97	0.06008	0.00173	0.08567	0.00185	0.70956	0.01875		606	26	530	11	544	11		2.64%	530	11
MO18-70	66	182	0.36	0.05535	0.00187	0.07163	0.00161	0.54658	0.01705		426	34	446	10	443	11		-0.67%	446	10
MO18-71	84	199	0.42	0.06705	0.00156	0.12119	0.00249	1.12005	0.02382		839	20	737	14	763	11		3.53%	737	14
MO18-72	57	124	0.45	0.05340	0.00294	0.05280	0.00143	0.38867	0.02005		346	69	332	9	333	15		0.30%	332	9
MO18-73	39	110	0.35	0.05735	0.00244	0.07032	0.00174	0.55591	0.02188		505	45	438	10	449	14		2.51%	438	10
MO18-74	54	75	0.72	0.06867	0.00461	0.10957	0.00370	1.03717	0.06481		889	75	670	21	723	32		7.91%	670	21
MO18-75	65	137	0.48	0.07066	0.00172	0.16959	0.00358	1.65172	0.03700		948	21	1010	20	990	14		-6.14%	948	21
MO18-76	59	143	0.41	0.26046	0.00310	0.65862	0.01259	23.64634	0.27056		3249	16	3262	49	3254	11		-0.40%	3249	16
MO18-77	258	218	1.18	0.06916	0.00143	0.15448	0.00307	1.47275	0.02807		904	18	926	17	919	12		-0.76%	926	17
MO18-78	56	338	0.17	0.06000	0.00147	0.08694	0.00178	0.71911	0.01616		604	22	537	11	550	10		2.42%	537	11
M	1	3	0.	0.07	0.	0.1	0.	1.5	0.		997	1	941	1	958	1		1.8	9	1

O18-79	69	05	56	238	00133	5719	00306	6824	02643			8		7		0		1%	41	7
MO18-80	122	397	0.31	0.05677	0.00142	0.07013	0.00143	0.54877	0.01262		483	23	437	9	444	8		1.60%	437	9
MO18-81	211	243	0.87	0.11730	0.00178	0.25437	0.00493	4.11284	0.05701		1915	17	1461	25	1657	11		31.07%		
MO18-82	318	255	1.25	0.06617	0.00160	0.10240	0.00212	0.93395	0.02071		812	21	628	12	670	11		6.69%	628	12
MO18-83	113	219	0.52	0.06132	0.00173	0.09561	0.00207	0.80807	0.02086		650	25	589	12	601	12		2.04%	589	12
MO18-84	42	715	0.06	0.11750	0.00138	0.25751	0.00470	4.17058	0.04511		1919	18	1477	24	1668	9		29.93%		
MO18-85	98	92	1.07	0.06391	0.00228	0.14021	0.00336	1.23510	0.04082		739	34	846	19	817	19		-3.43%	846	19
MO18-86	93	148	0.63	0.05821	0.00235	0.07630	0.00188	0.61219	0.02278		538	41	474	11	485	14		2.32%	474	11
MO18-87	70	282	0.25	0.05839	0.00176	0.06661	0.00145	0.53608	0.01487		544	28	416	9	436	10		4.81%	416	9
MO18-88	165	250	0.66	0.12209	0.00198	0.23218	0.00459	3.90674	0.05719		1530	87	1302	26	1391	30		17.51%		
MO18-89	230	847	0.27	0.21319	0.00230	0.29237	0.00531	8.59069	0.08483		2761	40	1606	27	2173	13		71.92%		
MO18-90	40	104	0.38	0.16789	0.00258	0.48723	0.00995	11.27386	0.16359		2537	17	2559	43	2546	14		-0.86%	2537	17
MO18-91	92	359	0.26	0.17226	0.00211	0.32996	0.00618	7.83327	0.08801		2561	40	1834	30	2200	12		39.64%	2561	40
MO18-	102	186	0.55	0.05881	0.0019	0.10162	0.0023	0.82355	0.0249		560	31	624	14	610	14		-2.24%	624	14

92					3		1		9											
MO18-93	178	181	0.98	0.17427	0.00225	0.49833	0.00961	11.96815	0.14622		2599	17	2607	41	2602	11		-0.31%	2599	17
MO18-94	41	158	0.26	0.06431	0.00204	0.11189	0.00254	0.99165	0.02889		752	28	684	15	700	15		2.34%	684	15
MO18-95	69	66	1.04	0.07190	0.00399	0.17400	0.00565	1.72405	0.08859		983	55	1034	31	1018	33		-4.93%	983	55
MO18-96	193	312	0.62	0.06526	0.00159	0.09033	0.00188	0.81245	0.01805		783	21	557	11	604	10		8.44%	557	11
MO18-97	124	237	0.52	0.05973	0.00156	0.09932	0.00209	0.81749	0.01957		594	23	610	12	607	11		-0.49%	610	12
MO18-98	119	351	0.34	0.06827	0.00116	0.16466	0.00316	1.54914	0.02420		877	18	983	17	950	10		-3.36%	983	17
MO18-99	78	176	0.44	0.06031	0.00191	0.10045	0.00227	0.83488	0.02440		615	29	617	13	616	14		-0.16%	617	13
MO18-100	50	137	0.36	0.05596	0.00225	0.08293	0.00201	0.63960	0.02395		451	43	514	12	502	15		-2.33%	514	12
MO22A-01	70	79	0.89	0.06064	0.00172	0.82130	0.02140	0.09825	0.00169		626	29	609	12	604	10		0.83%	604	10
MO22A-02	91	153	0.60	0.05792	0.00115	0.83838	0.01544	0.10501	0.00148		527	19	618	9	644	9		-4.04%	644	9
MO22A-03	34	35	0.96	0.12613	0.00221	6.26639	0.10140	0.36040	0.00583		2045	13	2014	14	1984	28		3.07%	2045	13
MO22A-	68	88	0.77	0.11994	0.00140	6.04743	0.06666	0.36573	0.00483		1955	11	1983	10	2009	23		-2.69%	1955	11

04																				
MO22A-05	129	166	0.78	0.05772	0.00118	0.77780	0.01470	0.09775	0.00139		519	20	584	8	601	8		-2.83%	601	8
MO22A-06	89	88	1.01	0.06263	0.00148	1.04523	0.02268	0.12105	0.00189		696	22	727	11	737	11		-1.36%	737	11
MO22A-07	85	389	0.22	0.05471	0.00088	0.56056	0.00836	0.07432	0.00095		400	15	452	5	462	6		-2.16%	462	6
MO22A-08	66	91	0.72	0.06065	0.00144	1.00282	0.02199	0.11993	0.00187		627	23	705	11	730	11		-3.42%	730	11
MO22A-09	92	105	0.88	0.05728	0.00174	0.57679	0.01603	0.07304	0.00127		502	32	462	10	454	8		1.76%	454	8
MO22A-10	52	70	0.75	0.06146	0.00183	0.90144	0.02461	0.10639	0.00188		655	30	652	13	652	11		0.00%	652	11
MO22A-11	225	84	2.67	0.15572	0.00157	10.37783	0.10115	0.48341	0.00627		2410	10	2469	9	2542	27		-5.19%	2410	10
MO22A-12	30	103	0.29	0.06403	0.00134	1.16292	0.02251	0.13173	0.00195		743	19	783	11	798	11		-1.88%	798	11
MO22A-13	385	476	0.81	0.07331	0.00113	0.60927	0.00855	0.06028	0.00079		1023	13	483	5	377	5		28.12%		
MO22A-14	31	504	0.06	0.11760	0.00077	5.57321	0.03666	0.34374	0.00387		1920	11	1912	6	1905	19		0.79%	1920	11
MO22A	26	34	0.75	0.06540	0.0022	1.15385	0.0361	0.12798	0.0025		787	34	779	17	776	15		0.39%	776	15

-15					4		9		5											
MO22A-16	174	250	0.70	0.05538	0.00110	0.56693	0.01046	0.07426	0.00103		428	19	456	7	462	6		-1.30%	462	6
MO22A-17	204	240	0.85	0.06170	0.00103	0.81260	0.01248	0.09553	0.00126		664	15	604	7	588	7		2.72%	588	7
MO22A-18	91	173	0.53	0.19065	0.00140	13.53617	0.09922	0.51499	0.00609		2748	10	2718	7	2678	26		2.61%	2748	10
MO22A-19	118	145	0.81	0.06429	0.00140	0.88631	0.01771	0.09999	0.00150		751	20	644	10	614	9		4.89%	614	9
MO22A-20	69	117	0.59	0.06727	0.00148	0.95820	0.01927	0.10332	0.00157		846	20	682	10	634	9		7.57%	634	9
MO22A-21	97	172	0.56	0.06108	0.00134	0.89738	0.01819	0.10656	0.00157		642	21	650	10	653	9		-0.46%	653	9
MO22A-22	539	664	0.81	0.07867	0.00070	1.76307	0.01499	0.16255	0.00188		1164	11	1032	6	971	10		6.28%	971	10
MO22A-23	92	132	0.70	0.06590	0.00131	1.16817	0.02139	0.12857	0.00186		803	18	786	10	780	11		0.77%	780	11
MO22A-24	120	237	0.51	0.05639	0.00108	0.56929	0.01011	0.07323	0.00100		468	18	458	7	456	6		0.44%	456	6
MO22A-25	170	305	0.56	0.05619	0.00117	0.69835	0.01353	0.09015	0.00126		460	21	538	8	556	7		-3.24%	556	7
MO2	14	16	0.8	0.06266	0.00	0.8685	0.01	0.1005	0.00		697	17	635	8	618	8		2.75%	61	8

ACCEPTED MANUSCRIPT

2A-26	1	8	4		120	7	532	4	141										8	
MO22A-27	227	299	0.76	0.06345	0.00092	1.07030	0.01444	0.12234	0.00155		723	13	739	7	744	9		-0.67%	744	9
MO22A-28	356	294	1.21	0.06056	0.00092	0.85720	0.01213	0.10266	0.00131		624	14	629	7	630	8		-0.16%	630	8
MO22A-29	197	286	0.69	0.05577	0.00108	0.55563	0.00993	0.07227	0.00099		443	19	449	6	450	6		-0.22%	450	6
MO22A-30	188	272	0.69	0.07225	0.00089	1.64445	0.01891	0.16508	0.00203		993	11	987	7	985	11		0.20%	985	11
MO22A-31	76	102	0.74	0.06196	0.00168	0.82492	0.02048	0.09656	0.00161		673	27	611	11	594	9		2.86%	594	9
MO22A-32	174	603	0.29	0.06219	0.00073	0.87120	0.00961	0.10160	0.00121		681	11	636	5	624	7		1.92%	624	7
MO22A-33	65	272	0.24	0.04605	0.00653	0.43752	0.06160	0.06891	0.00122			258	369	44	430	7		-14.19%		
MO22A-34	75	105	0.71	0.06118	0.00143	0.89785	0.01932	0.10643	0.00163		646	22	651	10	652	9		-0.15%	652	9
MO22A-35	118	219	0.54	0.06179	0.00114	0.82186	0.01399	0.09647	0.00132		667	17	609	8	594	8		2.53%	594	8
MO22A-36	142	367	0.39	0.05651	0.00097	0.58614	0.00932	0.07523	0.00099		472	16	468	6	468	6		0.00%	468	6
M	1	3	0.	0.05	0.	0.6	0.	0.0	0.		557	1	479	7	462	6		3.6	4	6

O22A-37	65	01	55	874	00109	0223	01035	7436	00101			7						8%	62	
MO22A-38	67	246	0.27	0.06529	0.00097	1.07950	0.01490	0.11993	0.00154		784	13	743	7	730	9		1.78%	730	9
MO22A-39	87	243	0.36	0.05425	0.00115	0.55776	0.01096	0.07457	0.00105		381	21	450	7	464	6		-3.02%	464	6
MO22A-40	114	98	1.16	0.13283	0.00153	7.08242	0.07736	0.38671	0.00511		2136	10	2122	10	2108	24		1.33%	2136	10
MO22A-41	263	748	0.35	0.12110	0.00075	5.99074	0.03758	0.35878	0.00397		1972	11	1975	5	1976	19		-0.20%	1972	11
MO22A-42	44	153	0.29	0.05588	0.00141	0.57237	0.01325	0.07430	0.00115		448	26	460	9	462	7		-0.43%	462	7
MO22A-43	49	36	1.38	0.06785	0.00259	1.19436	0.04168	0.12767	0.00276		864	38	798	19	775	16		2.97%	775	16
MO22A-44	45	131	0.34	0.05782	0.00173	0.60513	0.01660	0.07591	0.00130		523	32	480	11	472	8		1.69%	472	8
MO22A-45	163	155	1.05	0.05938	0.00126	0.82132	0.01609	0.10031	0.00145		581	20	609	9	616	8		-1.14%	616	8
MO22A-46	96	277	0.35	0.06151	0.00097	0.85210	0.01249	0.10048	0.00130		657	14	626	7	617	8		1.46%	617	8
MO22A-47	76	163	0.46	0.84080	0.00452	271.68826	1.72716	2.34364	0.02673		4992	9	5695	6	7781	52		-35.84%		

MO22A-48	32	253	0.13	0.05940	0.00111	0.65948	0.01136	0.08052	0.00109		582	17	514	7	499	7		3.01%	499	7
MO22A-49	94	260	0.36	0.05842	0.00105	0.69384	0.01156	0.08614	0.00115		546	17	535	7	533	7		0.38%	533	7
MO22A-50	104	88	1.19	0.08403	0.00371	1.98547	0.08125	0.17136	0.00281		1293	88	1111	28	1020	15		26.76%		
MO22A-51	17	395	0.04	0.12394	0.00089	6.59598	0.04716	0.38600	0.00438		2014	11	2059	6	2104	20		-4.28%	2014	11
MO22A-52	163	185	0.88	0.06105	0.00119	0.85885	0.01545	0.10204	0.00142		641	18	629	8	626	8		0.48%	626	8
MO22A-53	98	297	0.33	0.06034	0.00114	0.60867	0.01056	0.07317	0.00100		616	17	483	7	455	6		6.15%	455	6
MO22A-54	40	81	0.49	0.06044	0.00173	0.86218	0.02277	0.10347	0.00176		619	29	631	12	635	10		-0.63%	635	10
MO22A-55	140	205	0.68	0.06829	0.00105	1.31206	0.01873	0.13936	0.00181		877	13	851	8	841	10		1.19%	841	10
MO22A-56	35	44	0.80	0.11796	0.00286	2.90776	0.06201	0.17879	0.00329		1926	17	1384	16	1060	18		81.70%		
MO22A-57	82	249	0.33	0.05595	0.00133	0.55831	0.01219	0.07238	0.00108		450	24	450	8	450	6		0.00%	450	6
MO22A-	134	279	0.48	0.05848	0.00181	0.56324	0.01594	0.06985	0.00123		548	33	454	10	435	7		4.37%	435	7

58																				
MO22A-59	116	115	1.01	0.06584	0.00157	1.13019	0.02477	0.12450	0.00195		801	22	768	12	756	11		1.59%	756	11
MO22A-60	177	144	1.23	0.07360	0.00120	1.66055	0.02497	0.16365	0.00221		1031	14	994	10	977	12		1.74%	977	12
MO22A-61	106	134	0.79	0.07086	0.00592	0.83513	0.06775	0.08548	0.00170		953	177	616	37	529	10		16.45%		
MO22A-62	85	158	0.54	0.05765	0.00202	0.60772	0.01951	0.07646	0.00145		516	39	482	12	475	9		1.47%	475	9
MO22A-63	204	218	0.94	0.06245	0.00130	0.85133	0.01624	0.09889	0.00142		690	19	625	9	608	8		2.80%	608	8
MO22A-64	28	46	0.60	0.06475	0.00263	0.88289	0.03266	0.09890	0.00218		766	42	643	18	608	13		5.76%	608	13
MO22A-65	108	269	0.40	0.06027	0.00108	0.80407	0.01331	0.09677	0.00129		613	16	599	7	595	8		0.67%	595	8
MO22A-66	101	302	0.34	0.06356	0.00106	0.78761	0.01215	0.08988	0.00118		727	15	590	7	555	7		6.31%	555	7
MO22A-67	115	175	0.66	0.06825	0.00116	1.23951	0.01947	0.13173	0.00177		876	15	819	9	798	10		2.63%	798	10
MO22A-68	119	468	0.25	0.05878	0.00087	0.58191	0.00801	0.07180	0.00089		559	13	466	5	447	5		4.25%	447	5
MO22A	81	192	0.42	0.06297	0.0011	0.99016	0.0164	0.11405	0.0015		707	16	699	8	696	9		0.43%	696	9

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MO22A-70	321	466	0.69	0.11535	0.00090	5.14404	0.03908	0.32347	0.00369		1885	10	1843	6	1807	18		4.32%	1885	10
MO22A-71	101	227	0.44	0.06152	0.00126	0.69891	0.01318	0.08241	0.00117		657	19	538	8	510	7		5.49%	510	7
MO22A-72	105	283	0.37	0.05716	0.00117	0.55569	0.01051	0.07051	0.00098		498	20	449	7	439	6		2.28%	439	6
MO22A-73	77	641	0.12	0.06962	0.00083	1.25077	0.01396	0.13032	0.00156		917	11	824	6	790	9		4.30%	790	9
MO22A-74	114	536	0.21	0.05885	0.00089	0.60031	0.00846	0.07400	0.00092		562	14	477	5	460	6		3.70%	460	6
MO22A-75	31	358	0.09	0.12125	0.00093	5.50279	0.04113	0.32921	0.00374		1975	10	1901	6	1835	18		7.63%	1975	10
MO22A-76	691	1093	0.63	0.06635	0.00401	0.84550	0.04960	0.09243	0.00133		817	130	622	27	570	8		9.12%	570	8
MO22A-77	237	302	0.78	0.06446	0.00099	1.00695	0.01430	0.11332	0.00145		757	13	707	7	692	8		2.17%	692	8
MO22A-78	127	201	0.63	0.05812	0.00134	0.56033	0.01185	0.06994	0.00103		534	23	452	8	436	6		3.67%	436	6
MO22A-79	169	170	1.00	0.05634	0.00150	0.54362	0.01332	0.06999	0.00110		466	28	441	9	436	7		1.15%	436	7
MO2	33	29	1.1	0.06064	0.00	0.8098	0.01	0.0968	0.00		626	17	602	8	596	8		1.01%	59	8

2A-80	7	2	5		110	8	363	9	130										6	
MO22A-81	157	273	0.58	0.06270	0.00107	0.86879	0.01375	0.10053	0.00132		698	15	635	7	618	8		2.75%	618	8
MO22A-82	207	450	0.46	0.06080	0.00087	0.80079	0.01061	0.09555	0.00118		632	13	597	6	588	7		1.53%	588	7
MO22A-83	45	102	0.44	0.06760	0.00160	1.06172	0.02306	0.11393	0.00178		856	22	735	11	696	10		5.60%	696	10
MO22A-84	244	338	0.72	0.07188	0.00090	1.49534	0.01747	0.15091	0.00184		983	11	928	7	906	10		2.43%	906	10
MO22A-85	147	328	0.45	0.05825	0.00118	0.58316	0.01089	0.07263	0.00101		539	19	466	7	452	6		3.10%	452	6
MO22A-86	35	73	0.48	0.06183	0.00199	0.92380	0.02735	0.10840	0.00198		668	34	664	14	663	12		0.15%	663	12
MO22A-87	271	353	0.77	0.07713	0.00108	1.81237	0.02359	0.17047	0.00217		1125	12	1050	9	1015	12		10.84%		
MO22A-88	89	149	0.60	0.04651	0.00559	0.46855	0.05552	0.07306	0.00150		24	239	390	38	455	9		-14.29%		
MO22A-89	180	118	1.53	0.06294	0.00159	0.87367	0.02028	0.10071	0.00158		706	25	638	11	619	9		3.07%	619	9
MO22A-90	79	218	0.36	0.06030	0.00130	0.77922	0.01545	0.09375	0.00135		614	21	585	9	578	8		1.21%	578	8
M	3	8	0.	0.06	0.	1.2	0.	0.1	0.		839	2	816	1	809	1		0.8	8	1

O22A-91	3	8	37	703	00165	3475	02797	3364	00214			3		3		2		7%	09	2
MO22A-92	338	117	2.90	0.06000	0.00162	0.79230	0.01974	0.09581	0.00155		604	28	592	11	590	9		0.34%	590	9
MO22A-93	133	304	0.44	0.06183	0.00110	0.78690	0.01294	0.09234	0.00123		668	16	589	7	569	7		3.51%	569	7
MO22A-94	129	282	0.46	0.06776	0.00114	1.23884	0.01924	0.13265	0.00176		861	14	818	9	803	10		1.87%	803	10
MO22A-95	224	227	0.99	0.06900	0.00130	0.85838	0.01477	0.09027	0.00125		899	16	629	8	557	7		12.93%		
MO22A-96	74	136	0.54	0.06175	0.00153	0.84796	0.01928	0.09964	0.00155		665	24	624	11	612	9		1.96%	612	9
MO22A-97	142	192	0.74	0.06595	0.00129	1.07604	0.01935	0.11838	0.00166		805	17	742	9	721	10		2.91%	721	10
MO22A-98	358	219	1.63	0.07641	0.00122	1.80687	0.02662	0.17158	0.00229		1106	13	1048	10	1021	13		8.33%	1106	13
MO22A-99	228	242	0.94	0.12560	0.00348	6.50794	0.15721	0.37581	0.00511		2037	50	2047	21	2057	24		-0.97%	2037	50
MO22A-100	49	106	0.46	0.06428	0.00188	0.82199	0.02198	0.09279	0.00160		751	29	609	12	572	9		6.47%	572	9
MO23-	23	282	0.08	0.05949	0.0004	0.83326	0.0064	0.10157	0.0010		585	11	615	4	624	6		-1.44%	624	6

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MO23-02	216	380	0.57	0.05488	0.00045	0.56032	0.00442	0.07404	0.00080		407	12	452	3	460	5		-1.74%	460	5
MO23-03	65	519	0.13	0.12061	0.00083	5.91329	0.03987	0.35554	0.00388		1965	10	1963	6	1961	18		0.20%	1965	10
MO23-04	102	119	0.86	0.05621	0.00058	0.55513	0.00536	0.07162	0.00080		461	11	448	3	446	5		0.45%	446	5
MO23-05	110	347	0.32	0.05367	0.00042	0.54223	0.00410	0.07327	0.00078		357	12	440	3	456	5		-3.51%	456	5
MO23-06	144	613	0.24	0.05907	0.00052	0.69314	0.00579	0.08510	0.00093		570	11	535	3	526	6		1.71%	526	6
MO23-07	173	375	0.46	0.05567	0.00054	0.55844	0.00514	0.07275	0.00080		439	11	451	3	453	5		-0.44%	453	5
MO23-08	54	309	0.18	0.11772	0.00072	5.63457	0.03413	0.34711	0.00370		1922	11	1921	5	1921	18		0.05%	1922	11
MO23-09	93	197	0.47	0.05885	0.00074	0.88057	0.01032	0.10852	0.00127		562	12	641	6	664	7		-3.46%	664	7
MO23-10	36	114	0.32	0.06118	0.00043	0.90574	0.00622	0.10737	0.00114		646	12	655	3	657	7		-0.30%	657	7
MO23-11	22	281	0.08	0.06427	0.00053	1.08455	0.00855	0.12238	0.00133		751	11	746	4	744	8		0.27%	744	8
MO23-12	173	278	0.62	0.06439	0.00046	1.09971	0.00762	0.12386	0.00132		754	12	753	4	753	8		0.00%	753	8
MO23-13	256	480	0.53	0.05531	0.00068	0.54896	0.00631	0.07198	0.00083		425	12	444	4	448	5		-0.89%	448	5
MO23-14	117	214	0.55	0.07142	0.00065	1.67217	0.01433	0.16980	0.00189		969	11	998	5	1011	10		-4.15%	969	11
M	1	1	0.	0.05	0.	0.5	0.	0.0	0.		428	1	446	6	449	5		-	4	5

O23-15	62	75	92	539	00095	5125	00879	7218	00091			6						0.67%	49	
MO23-16	34	86	0.39	0.07414	0.00149	1.84171	0.03065	0.18017	0.00204		1045	42	1060	11	1068	11		-2.15%	1045	42
MO23-17	88	220	0.40	0.06102	0.00075	0.87815	0.01014	0.10437	0.00122		640	11	640	5	640	7		0.00%	640	7
MO23-18	69	116	0.60	0.06808	0.00073	1.32368	0.01332	0.14100	0.00162		871	11	856	6	850	9		0.71%	850	9
MO23-19	85	111	0.77	0.05839	0.00066	0.61480	0.00648	0.07636	0.00087		544	11	487	4	474	5		2.74%	474	5
MO23-20	100	199	0.50	0.12203	0.00106	6.07026	0.05056	0.36077	0.00417		1986	10	1986	7	1986	20		0.00%	1986	10
MO23-21	22	281	0.08	0.05994	0.00065	0.78599	0.00795	0.09511	0.00107		601	11	589	5	586	6		0.51%	586	6
MO23-22	152	210	0.72	0.06415	0.00039	1.02300	0.00623	0.11566	0.00122		747	12	715	3	706	7		1.27%	706	7
MO23-23	161	917	0.18	0.05942	0.00064	0.65547	0.00658	0.08000	0.00090		583	11	512	4	496	5		3.23%	496	5
MO23-24	66	207	0.32	0.14124	0.00077	7.73786	0.04269	0.39734	0.00418		2242	11	2201	5	2157	19		3.94%	2242	11
MO23-25	138	339	0.41	0.05618	0.00059	0.55580	0.00547	0.07175	0.00080		459	11	449	4	447	5		0.45%	447	5
MO23-26	121	320	0.38	0.05951	0.00055	0.72395	0.00635	0.08824	0.00097		586	11	553	4	545	6		1.47%	545	6
MO23-27	336	269	1.25	0.06640	0.00129	1.02642	0.01834	0.11212	0.00156		819	17	717	9	685	9		4.67%	685	9
MO23-	41	56	0.74	0.06226	0.0005	0.95682	0.0081	0.11145	0.0012		683	11	682	4	681	7		0.15%	681	7

28					6		4		2											
MO23-29	114	231	0.49	0.06044	0.00039	0.86416	0.00550	0.10371	0.00110		619	12	632	3	636	6		-0.63%	636	6
MO23-30	641	846	0.76	0.05989	0.00061	0.82225	0.00795	0.09958	0.00111		600	11	609	4	612	7		-0.49%	612	7
MO23-31	21	266	0.08	0.06265	0.00090	0.95110	0.01270	0.11011	0.00134		696	13	679	7	673	8		0.89%	673	8
MO23-32	30	80	0.38	0.06625	0.00076	1.04922	0.01129	0.11487	0.00133		814	11	728	6	701	8		3.85%	701	8
MO23-33	72	115	0.62	0.05701	0.00060	0.57182	0.00567	0.07274	0.00081		492	11	459	4	453	5		1.32%	453	5
MO23-34	101	232	0.44	0.06261	0.00114	0.93105	0.01565	0.10785	0.00143		695	16	668	8	660	8		1.21%	660	8
MO23-35	45	118	0.38	0.22184	0.00307	16.76738	0.13872	0.54819	0.00608		2994	23	2922	8	2818	25		6.25%	2994	23
MO23-36	128	249	0.51	0.06431	0.00072	1.19959	0.01152	0.12402	0.00142		752	11	753	6	754	8		-0.13%	754	8
MO23-37	40	156	0.26	0.05672	0.00046	0.56068	0.00439	0.07170	0.00077		481	11	452	3	446	5		1.35%	446	5
MO23-38	228	580	0.39	0.05456	0.00063	0.53427	0.00579	0.07103	0.00081		394	11	435	4	442	5		-1.58%	442	5
MO23-39	70	210	0.33	0.05624	0.00071	0.55232	0.00650	0.07123	0.00083		462	12	447	4	444	5		0.68%	444	5
MO23-40	132	203	0.65	0.06596	0.00155	1.17383	0.02186	0.11808	0.00139		805	50	741	11	720	8		2.92%	720	8
MO23-41	21	267	0.08	0.09792	0.00085	3.57898	0.02953	0.26510	0.00300		1585	10	1545	7	1516	15		4.55%	1585	10
M	9	1	0.	0.06	0.	0.8	0.	0.1	0.		691	1	639	4	624	6		2.4	6	6

O23-42	5	80	53	248	00052	7589	00698	0168	00111			1						0%	24	
MO23-43	131	308	0.43	0.07056	0.00119	1.48684	0.01928	0.15283	0.00166		945	35	925	8	917	9		0.87%	917	9
MO23-44	114	372	0.31	0.06175	0.00079	0.82074	0.00979	0.09641	0.00114		665	12	608	5	593	7		2.53%	593	7
MO23-45	171	131	1.30	0.21296	0.00144	16.23499	0.10961	0.55295	0.00620		2928	10	2891	6	2837	26		3.21%	2928	10
MO23-46	57	59	0.96	0.05947	0.00051	0.78412	0.00646	0.09564	0.00104		584	11	588	4	589	6		-0.17%	589	6
MO23-47	246	326	0.75	0.06249	0.00077	0.89513	0.01027	0.10389	0.00121		691	11	649	6	637	7		1.88%	637	7
MO23-48	80	139	0.58	0.06119	0.00079	0.78753	0.00945	0.09335	0.00110		646	12	590	5	575	6		2.61%	575	6
MO23-49	119	106	1.12	0.06420	0.00068	0.90279	0.00898	0.10200	0.00116		748	11	653	5	626	7		4.31%	626	7
MO23-50	91	162	0.56	0.06905	0.00047	1.29668	0.00860	0.13621	0.00145		900	12	844	4	823	8		2.55%	823	8
MO23-51	20	256	0.08	0.18060	0.00315	10.39957	0.13419	0.41763	0.00492		2658	30	2471	12	2250	22		18.13%		
MO23-52	265	280	0.95	0.07574	0.00068	1.73536	0.01472	0.16618	0.00185		1088	10	1022	5	991	10		3.13%	991	10
MO23-53	34	130	0.26	0.05683	0.00075	0.56881	0.00704	0.07259	0.00085		485	12	457	5	452	5		1.11%	452	5
MO23-54	86	195	0.44	0.16113	0.00119	10.28352	0.07477	0.46291	0.00524		2468	10	2461	7	2452	23		0.65%	2468	10
MO23-	63	69	0.90	0.06118	0.0004	0.87751	0.0064	0.10403	0.0011		646	12	640	3	638	7		0.31%	638	7

55					6		2		2											
MO23-56	213	505	0.42	0.05952	0.00056	0.80049	0.00720	0.09755	0.00108		586	11	597	4	600	6		-0.50%	600	6
MO23-57	175	243	0.72	0.05710	0.00067	0.60416	0.00667	0.07675	0.00088		495	11	480	4	477	5		0.63%	477	5
MO23-58	62	240	0.26	0.07011	0.00093	1.48610	0.01846	0.15375	0.00187		932	12	925	8	922	10		0.33%	922	10
MO23-59	42	80	0.52	0.05704	0.00071	0.55283	0.00645	0.07030	0.00081		493	12	447	4	438	5		2.05%	438	5
MO23-60	120	191	0.63	0.06207	0.00098	0.90777	0.01328	0.10609	0.00134		677	14	656	7	650	8		0.92%	650	8
MO23-61	19	241	0.08	0.05562	0.00133	0.54236	0.01138	0.07073	0.00081		437	54	440	7	441	5		-0.23%	441	5
MO23-62	91	253	0.36	0.05662	0.00063	0.57622	0.00602	0.07382	0.00084		477	11	462	4	459	5		0.65%	459	5
MO23-63	102	253	0.40	0.06891	0.00081	1.17571	0.01293	0.12376	0.00145		896	11	789	6	752	8		4.92%	752	8
MO23-64	39	117	0.34	0.06183	0.00216	0.81473	0.02622	0.09558	0.00129		668	77	605	15	588	8		2.89%	588	8
MO23-65	29	58	0.50	0.05762	0.00170	0.57107	0.01539	0.07189	0.00086		515	66	459	10	448	5		2.46%	448	5
MO23-66	119	227	0.52	0.06087	0.00058	0.73260	0.00664	0.08729	0.00097		635	11	558	4	539	6		3.53%	539	6
MO23-67	100	254	0.39	0.05540	0.00077	0.53914	0.00704	0.07058	0.00084		428	13	438	5	440	5		-0.45%	440	5
MO23-68	118	175	0.67	0.05540	0.00055	0.55142	0.00524	0.07220	0.00080		428	11	446	3	449	5		-0.67%	449	5
M	8	3	0.	0.05	0.	0.5	0.	0.0	0.		459	1	451	3	449	5		0.4	4	5

O23-69	3	21	26	617	00054	5880	00510	7216	00080			1						5%	49	
MO23-70	191	357	0.53	0.05640	0.00087	0.56675	0.00813	0.07288	0.00089		468	14	456	5	453	5		0.66%	453	5
MO23-71	19	241	0.08	0.05601	0.00056	0.56102	0.00528	0.07266	0.00081		453	11	452	3	452	5		0.00%	452	5
MO23-72	216	338	0.64	0.07412	0.00056	1.73667	0.01277	0.16994	0.00184		1045	11	1022	5	1012	10		3.26%	1045	11
MO23-73	397	291	1.36	0.06653	0.00140	1.18217	0.02100	0.12887	0.00145		823	45	792	10	781	8		1.41%	781	8
MO23-74	75	223	0.34	0.13385	0.00095	6.94613	0.04825	0.37640	0.00416		2149	10	2105	6	2059	19		4.37%	2149	10
MO23-75	54	109	0.49	0.07105	0.00060	1.26045	0.01011	0.12868	0.00141		959	11	828	5	780	8		6.15%	780	8
MO23-76	45	198	0.23	0.06157	0.00184	0.87073	0.02375	0.10256	0.00126		659	66	636	13	629	7		1.11%	629	7
MO23-78	75	136	0.55	0.06172	0.00049	0.85112	0.00657	0.10002	0.00108		664	11	625	4	615	6		1.63%	615	6
MO23-79	313	396	0.79	0.07966	0.00138	1.89435	0.02527	0.17247	0.00189		1189	35	1079	9	1026	10		15.89%		
MO23-80	131	338	0.39	0.06166	0.00059	0.73464	0.00670	0.08641	0.00096		662	11	559	4	534	6		4.68%	534	6
MO23-81	18	231	0.08	0.06252	0.00072	0.71230	0.00769	0.08263	0.00095		692	11	546	5	512	6		6.64%	512	6
MO23-82	246	289	0.85	0.06299	0.00056	0.92488	0.00781	0.10650	0.00117		708	11	665	4	652	7		1.99%	652	7
MO23-	226	295	0.77	0.06290	0.0005	0.87523	0.0070	0.10092	0.0011		705	11	638	4	620	6		2.90%	620	6

83					2		1		0											
MO23-84	313	379	0.83	0.06282	0.00062	0.95823	0.00902	0.11063	0.00124		702	11	682	5	676	7		0.89%	676	7
MO23-85	77	219	0.35	0.06616	0.00116	1.20450	0.01645	0.13205	0.00145		811	38	803	8	800	8		0.37%	800	8
MO23-86	80	327	0.25	0.17051	0.00092	8.54866	0.04722	0.36362	0.00383		2563	10	2291	5	1999	18		28.21%		
MO23-87	510	594	0.86	0.05914	0.00058	0.59213	0.00547	0.07261	0.00081		572	11	472	3	452	5		4.42%	452	5
MO23-88	4885	361	13.54	0.05937	0.00054	0.66491	0.00575	0.08123	0.00089		581	11	518	4	503	5		2.98%	503	5
MO23-89	112	361	0.31	0.06147	0.00062	0.70923	0.00676	0.08368	0.00094		656	11	544	4	518	6		5.02%	518	6
MO23-90	63	266	0.24	0.05991	0.00062	0.78333	0.00770	0.09483	0.00107		600	11	587	4	584	6		0.51%	584	6
MO23-91	18	233	0.08	0.06150	0.00063	0.80582	0.00781	0.09504	0.00107		657	11	600	4	585	6		2.56%	585	6
MO23-92	111	245	0.45	0.06019	0.00066	0.64208	0.00668	0.07737	0.00088		610	11	504	4	480	5		5.00%	480	5
MO23-93	61	201	0.30	0.05862	0.00194	0.56615	0.01735	0.07005	0.00088		553	74	456	11	436	5		4.59%	436	5
MO23-94	111	180	0.62	0.06486	0.00060	0.94971	0.00842	0.10620	0.00118		770	11	678	4	651	7		4.15%	651	7
MO23-95	165	234	0.70	0.12453	0.00263	4.98008	0.08351	0.29005	0.00374		2022	38	1816	14	1642	19		23.14%		
MO23-96	61	113	0.54	0.05833	0.00053	0.58290	0.00504	0.07248	0.00080		542	11	466	3	451	5		3.33%	451	5
M	4	3	0.	0.07	0.	1.7	0.	0.1	0.		105	1	101	5	100	1		5.0	1	1

O23-97	4	84	11	441	00060	2528	01344	6816	00184		3	1	8		2	0		9%	053	1
MO23-98	155	209	0.74	0.06813	0.00073	1.18749	0.01203	0.12642	0.00145		873	11	795	6	767	8		3.65%	767	8
MO23-99	128	145	0.89	0.06735	0.00113	0.89057	0.01378	0.09590	0.00125		849	14	647	7	590	7		9.66%	590	7
MO23-100	94	76	1.24	0.06483	0.00074	1.07264	0.01156	0.11999	0.00139		769	11	740	6	731	8		1.23%	731	8
MO24-01	18	43	0.41	0.06934	0.00151	1.32435	0.02664	0.13851	0.00202		909	20	856	12	836	11		2.39%	836	11
MO24-02	67	152	0.44	0.06038	0.00081	0.79975	0.00999	0.09606	0.00113		617	12	597	6	591	7		1.02%	591	7
MO24-03	110	362	0.30	0.06298	0.00082	0.96780	0.01169	0.11145	0.00132		708	12	687	6	681	8		0.88%	681	8
MO24-04	40	266	0.15	0.05682	0.00112	0.58774	0.00943	0.07501	0.00086		485	45	469	6	466	5		0.64%	466	5
MO24-05	61	142	0.42	0.06073	0.00088	0.87180	0.01173	0.10412	0.00127		630	13	637	6	639	7		-0.31%	639	7
MO24-06	106	119	0.89	0.05618	0.00105	0.57215	0.00998	0.07386	0.00096		459	18	459	6	459	6		0.00%	459	6
MO24-07	370	687	0.54	0.07201	0.00046	1.58563	0.01004	0.15970	0.00169		986	12	965	4	955	9		1.05%	955	9
MO24-08	233	295	0.79	0.06657	0.00067	1.11817	0.01058	0.12183	0.00137		824	11	762	5	741	8		2.83%	741	8
MO24-09	279	256	1.09	0.06256	0.00065	0.85461	0.00835	0.09907	0.00111		693	11	627	5	609	7		2.96%	609	7
M	2	2	1.	0.06	0.	0.8	0.	0.0	0.		674	1	622	5	608	7		2.3	6	7

O24-10	47	07	19	200	00072	4592	00922	9895	00114			1						0%	08	
MO24-11	54	255	0.21	0.13619	0.00080	7.53182	0.04411	0.40110	0.00425		2179	11	2177	5	2174	20		0.23%	2179	11
MO24-12	190	179	1.06	0.06067	0.00070	0.90146	0.00971	0.10777	0.00123		628	11	653	5	660	7		-1.06%	660	7
MO24-13	74	176	0.42	0.06481	0.01975	0.64829	0.19682	0.07255	0.00198		768	615	507	121	452	12		12.17%		
MO24-14	285	440	0.65	0.06620	0.00049	1.23206	0.00879	0.13497	0.00144		813	11	815	4	816	8		-0.12%	816	8
MO24-15	343	223	1.54	0.05963	0.00064	0.81539	0.00817	0.09918	0.00112		590	11	605	5	610	7		-0.82%	610	7
MO24-16	107	100	1.07	0.06176	0.00097	0.90354	0.01315	0.10611	0.00132		666	14	654	7	650	8		0.62%	650	8
MO24-17	193	303	0.64	0.06131	0.00062	0.91442	0.00878	0.10817	0.00121		650	11	659	5	662	7		-0.45%	662	7
MO24-18	94	159	0.59	0.05579	0.00086	0.56145	0.00805	0.07299	0.00089		444	14	452	5	454	5		-0.44%	454	5
MO24-19	129	206	0.62	0.10861	0.00074	4.88455	0.03244	0.32619	0.00352		1776	10	1800	6	1820	17		-2.42%	1776	10
MO24-20	93	307	0.30	0.05649	0.00060	0.55858	0.00560	0.07171	0.00080		472	11	451	4	446	5		1.12%	446	5
MO24-21	117	295	0.40	0.12729	0.00075	6.58668	0.03892	0.37529	0.00397		2061	11	2058	5	2054	19		0.34%	2061	11
MO24-22	143	121	1.19	0.12357	0.00091	6.26161	0.04490	0.36753	0.00406		2008	10	2013	6	2018	19		-0.50%	2008	10
MO24-	112	61	1.84	0.06770	0.0012	0.94165	0.0162	0.10088	0.0013		859	17	674	8	620	8		8.71%	620	8

23					7		5		7											
MO24-24	40	71	0.57	0.06576	0.00097	1.12219	0.01533	0.12376	0.00153		799	13	764	7	752	9		1.60%	752	9
MO24-25	195	415	0.47	0.05984	0.00053	0.73969	0.00627	0.08965	0.00098		598	11	562	4	553	6		1.63%	553	6
MO24-26	143	80	1.80	0.18871	0.00136	13.10842	0.09300	0.50380	0.00569		2731	10	2687	7	2630	24		3.84%	2731	10
MO24-27	191	938	0.20	0.06123	0.00040	0.84048	0.00541	0.09956	0.00105		647	12	619	3	612	6		1.14%	612	6
MO24-28	26	486	0.05	0.06011	0.00048	0.76832	0.00592	0.09270	0.00100		608	11	579	3	571	6		1.40%	571	6
MO24-29	85	187	0.46	0.06025	0.00065	0.84239	0.00860	0.10140	0.00114		613	11	620	5	623	7		-0.48%	623	7
MO24-30	96	136	0.70	0.06301	0.00079	0.83038	0.00973	0.09558	0.00112		709	11	614	5	588	7		4.42%	588	7
MO24-31	233	104	2.23	0.12294	0.00087	6.06613	0.04172	0.35788	0.00391		1999	10	1985	6	1972	19		1.37%	1999	10
MO24-32	153	260	0.59	0.06066	0.00059	0.74895	0.00687	0.08955	0.00099		627	11	568	4	553	6		2.71%	553	6
MO24-33	144	237	0.61	0.05706	0.00068	0.55504	0.00619	0.07055	0.00081		494	11	448	4	439	5		2.05%	439	5
MO24-34	86	275	0.31	0.05903	0.00061	0.67969	0.00656	0.08351	0.00093		568	11	527	4	517	6		1.93%	517	6
MO24-35	104	190	0.55	0.05807	0.00090	0.53284	0.00764	0.06656	0.00082		532	14	434	5	415	5		4.58%	415	5
MO24-36	92	164	0.56	0.06013	0.00069	0.76927	0.00820	0.09279	0.00106		608	11	579	5	572	6		1.22%	572	6
M	1	2	0.	0.06	0.	0.8	0.	0.1	0.		676	5	629	1	616	7		2.1	6	7

O24-37	44	50	58	206	00162	5733	02013	0019	00115			7		1				1%	16	
MO24-38	92	225	0.41	0.05530	0.00063	0.52307	0.00557	0.06860	0.00077		424	11	427	4	428	5		-0.23%	428	5
MO24-39	121	121	1.00	0.05679	0.00093	0.55101	0.00837	0.07037	0.00087		483	15	446	5	438	5		1.83%	438	5
MO24-40	206	584	0.35	0.05596	0.00046	0.55583	0.00441	0.07205	0.00077		451	11	449	3	448	5		0.22%	448	5
MO24-41	199	187	1.06	0.06094	0.00065	0.81345	0.00815	0.09682	0.00109		637	11	604	5	596	6		1.34%	596	6
MO24-42	120	120	1.00	0.06367	0.00084	1.06422	0.01302	0.12124	0.00144		731	12	736	6	738	8		-0.27%	738	8
MO24-43	92	39	2.37	0.11643	0.00118	5.44227	0.05216	0.33904	0.00407		1902	10	1892	8	1882	20		1.06%	1902	10
MO24-44	86	862	0.10	0.05665	0.00078	0.55548	0.00501	0.07111	0.00074		478	31	449	3	443	4		1.35%	443	4
MO24-45	63	190	0.33	0.05723	0.00138	0.56961	0.01201	0.07219	0.00084		500	54	458	8	449	5		2.00%	449	5
MO24-46	383	695	0.55	0.06563	0.00045	0.89903	0.00597	0.09935	0.00105		795	12	651	3	611	6		6.55%	611	6
MO24-47	79	120	0.66	0.05879	0.00085	0.57743	0.00774	0.07124	0.00085		559	13	463	5	444	5		4.28%	444	5
MO24-48	130	154	0.84	0.06742	0.00063	1.24467	0.01095	0.13391	0.00148		851	11	821	5	810	8		1.36%	810	8
MO24-49	103	244	0.42	0.05802	0.00135	0.68689	0.01403	0.08586	0.00096		531	52	531	8	531	6		0.00%	531	6
MO24-	71	80	0.88	0.12211	0.0009	6.04320	0.0451	0.35897	0.0040		1987	10	1982	7	1977	19		0.51%	198	10

50					5		0		0										7	
MO24-51	209	251	0.83	0.06559	0.000555	1.12435	0.00893	0.12434	0.00134		793	11	765	4	755	8		1.32%	755	8
MO24-52	115	140	0.82	0.06185	0.000722	0.86703	0.00942	0.10167	0.00116		669	11	634	5	624	7		1.60%	624	7
MO24-53	30	49	0.62	0.11546	0.001116	5.37365	0.05085	0.33759	0.00402		1887	10	1881	8	1875	19		0.64%	1887	10
MO24-54	98	206	0.48	0.05625	0.000667	0.54282	0.00605	0.06999	0.00080		462	11	440	4	436	5		0.92%	436	5
MO24-55	103	221	0.46	0.06385	0.000558	0.96366	0.00826	0.10948	0.00120		737	11	685	4	670	7		2.24%	670	7
MO24-56	24	32	0.75	0.06549	0.001600	1.16732	0.02635	0.12929	0.00199		790	24	785	12	784	11		0.13%	784	11
MO24-57	200	271	0.74	0.06396	0.001911	0.84886	0.02327	0.09626	0.00113		740	65	624	13	592	7		5.41%	592	7
MO24-58	95	261	0.36	0.05988	0.001277	0.75214	0.01355	0.09110	0.00102		599	47	569	8	562	6		1.25%	562	6
MO24-59	29	197	0.15	0.14922	0.002066	5.33026	0.04471	0.25906	0.00284		2337	24	1874	7	1485	15		57.37%		
MO24-60	84	100	0.84	0.05778	0.000900	0.56379	0.00816	0.07077	0.00087		521	14	454	5	441	5		2.95%	441	5
MO24-61	124	183	0.68	0.12985	0.000799	6.60811	0.03974	0.36915	0.00391		2096	10	2060	5	2025	18		3.51%	2096	10
MO24-62	16	110	0.15	0.05835	0.000777	0.65012	0.00801	0.08082	0.00095		543	12	509	5	501	6		1.60%	501	6
MO24-63	103	210	0.49	0.06036	0.000559	0.83980	0.00775	0.10092	0.00111		617	11	619	4	620	6		-0.16%	620	6
M	9	9	0.	0.05	0.	0.7	0.	0.0	0.		577	1	596	6	601	7		-	6	7

O24-64	2	4	99	928	00084	9799	01058	9764	00116			3						0.83%	01	
MO24-65	107	300	0.36	0.12857	0.00072	6.40361	0.03572	0.36129	0.00377		2079	11	2033	5	1988	18		4.58%	2079	11
MO24-66	150	167	0.90	0.06360	0.00060	0.99365	0.00890	0.11332	0.00125		728	11	701	5	692	7		1.30%	692	7
MO24-67	56	168	0.33	0.05848	0.00132	0.73631	0.01432	0.09132	0.00103		548	50	560	8	563	6		-0.53%	563	6
MO24-68	113	228	0.49	0.05541	0.00061	0.55045	0.00570	0.07205	0.00081		429	11	445	4	448	5		-0.67%	448	5
MO24-69	68	226	0.30	0.05696	0.00061	0.55940	0.00567	0.07124	0.00079		490	11	451	4	444	5		1.58%	444	5
MO24-70	132	455	0.29	0.06204	0.00046	0.91994	0.00651	0.10756	0.00114		675	11	662	3	659	7		0.46%	659	7
MO24-71	122	392	0.31	0.06109	0.00047	0.91687	0.00677	0.10888	0.00116		642	11	661	4	666	7		-0.75%	666	7
MO24-72	129	334	0.39	0.06542	0.00052	0.93199	0.00703	0.10333	0.00111		788	11	669	4	634	6		5.52%	634	6
MO24-73	59	161	0.37	0.05676	0.00071	0.57411	0.00670	0.07337	0.00084		482	12	461	4	456	5		1.10%	456	5
MO24-74	59	222	0.27	0.05442	0.00059	0.53611	0.00550	0.07146	0.00079		388	11	436	4	445	5		-2.02%	445	5
MO24-75	48	85	0.57	0.06282	0.00216	0.76988	0.02446	0.08888	0.00116		702	75	580	14	549	7		5.65%	549	7
MO24-76	59	138	0.43	0.05910	0.00073	0.69597	0.00802	0.08542	0.00098		571	11	536	5	528	6		1.52%	528	6
MO24-	115	356	0.32	0.05294	0.0004	0.52218	0.0044	0.07154	0.0007		326	11	427	3	445	5		-4.04%	445	5

77					8		7		7											
MO24-78	92	155	0.59	0.05634	0.00071	0.57301	0.00676	0.07377	0.00085		466	12	460	4	459	5		0.22%	459	5
MO24-79	105	231	0.45	0.05805	0.00058	0.57030	0.00539	0.07127	0.00078		532	11	458	3	444	5		3.15%	444	5
MO24-80	14	37	0.39	0.05943	0.00126	0.82469	0.01613	0.10067	0.00140		583	21	611	9	618	8		-1.13%	618	8
MO24-81	208	297	0.70	0.05990	0.00052	0.78666	0.00643	0.09526	0.00103		600	11	589	4	587	6		0.34%	587	6
MO24-82	203	168	1.21	0.06958	0.00063	1.35318	0.01157	0.14107	0.00155		916	10	869	5	851	9		2.12%	851	9
MO24-83	132	115	1.15	0.06086	0.00074	0.86048	0.00971	0.10257	0.00118		634	11	630	5	629	7		0.16%	629	7
MO24-84	183	180	1.02	0.06106	0.00062	0.81293	0.00775	0.09657	0.00107		641	11	604	4	594	6		1.68%	594	6
MO24-85	55	50	1.09	0.06339	0.00312	0.82720	0.03897	0.09464	0.00136		721	107	612	22	583	8		4.97%	583	8
MO24-86	121	149	0.81	0.05996	0.00066	0.84762	0.00871	0.10255	0.00115		602	11	623	5	629	7		-0.95%	629	7
MO24-87	59	261	0.23	0.06159	0.00054	0.87312	0.00731	0.10284	0.00111		660	11	637	4	631	6		0.95%	631	6
MO24-88	96	199	0.48	0.05742	0.00066	0.55921	0.00599	0.07064	0.00080		508	11	451	4	440	5		2.50%	440	5
MO24-89	183	316	0.58	0.06134	0.00049	0.85794	0.00651	0.10146	0.00108		651	11	629	4	623	6		0.96%	623	6
MO24-90	40	62	0.65	0.06372	0.00094	1.08076	0.01480	0.12303	0.00151		732	13	744	7	748	9		-0.53%	748	9
M	1	1	0.	0.05	0.	0.8	0.	0.0	0.		585	1	600	4	604	6		-	6	6

O24-91	42	70	84	948	00061	0523	00780	9820	00109			1						0.66%	04	
MO24-92	76	265	0.29	0.17231	0.00102	10.84154	0.06399	0.45643	0.00484		2580	10	2510	5	2424	21		6.44%	2580	10
MO24-93	257	708	0.36	0.05881	0.00040	0.74633	0.00488	0.09205	0.00096		560	12	566	3	568	6		-0.35%	568	6
MO24-94	76	181	0.42	0.05565	0.00066	0.56632	0.00628	0.07382	0.00083		438	11	456	4	459	5		-0.65%	459	5
MO24-95	46	80	0.58	0.05978	0.00084	0.77423	0.01015	0.09396	0.00112		596	13	582	6	579	7		0.52%	579	7
MO24-96	33	91	0.36	0.06109	0.00077	0.85696	0.01007	0.10176	0.00118		642	11	628	6	625	7		0.48%	625	7
MO24-97	36	95	0.37	0.05980	0.00077	0.83164	0.01003	0.10088	0.00118		596	12	615	6	620	7		-0.81%	620	7
MO24-98	49	87	0.57	0.05542	0.00089	0.56329	0.00843	0.07373	0.00091		429	15	454	5	459	5		-1.09%	459	5
MO24-99	231	399	0.58	0.06054	0.00048	0.81012	0.00619	0.09708	0.00104		623	11	603	3	597	6		1.01%	597	6
MO24-100	93	265	0.35	0.05713	0.00054	0.56679	0.00503	0.07197	0.00078		497	11	456	3	448	5		1.79%	448	5

Table 3. Analytical data for the dated Carboniferous zircons: 13 FR 52, MO 15, MO 16, MO 17, MO 26.

Spot No.	Th (ppm)	U (ppm)	Th/U	Ratios 207Pb/206Pb	±1σ	207Pb/235U	±1σ	206Pb/238U	±1σ		Ages (Ma) 207Pb/206Pb	±1σ	207Pb/235U	±1σ	206Pb/238U	±1σ		Discordance (%)	Best Ages	±1σ
13 FR 52-01	139	164	0.85	0.05704	0.00196	0.75868	0.02380	0.09651	0.00184		493	37	573	14	594	11		-3.54%	594	11
13 FR 52-02	8	547	0.02	0.05992	0.00101	0.81344	0.01264	0.09849	0.00129		601	15	604	7	606	8		-0.33%	606	8
13 FR 52-03	26	80	0.33	0.05244	0.00410	0.59476	0.04293	0.08229	0.00292		305	101	474	27	510	17		-7.06%	510	17
13 FR 52-04	84	847	0.10	0.16437	0.00214	10.37135	0.07288	0.45763	0.00502		2501	22	2468	7	2429	22		2.96%	2501	22
13 FR 52-05	88	31	2.88	0.06159	0.00457	0.71064	0.04841	0.08371	0.00291		660	87	545	29	518	17		5.21%	518	17
13 FR 52-06	124	200	0.62	0.13188	0.00355	6.81295	0.15214	0.37468	0.00561		2123	48	2087	20	2051	26		3.51%	2123	48
13 FR 52-07	199	267	0.75	0.10868	0.00104	5.27113	0.04766	0.35189	0.00418		1777	10	1864	8	1944	20		-8.59%	1777	10
13 FR 52-08	202	244	0.83	0.05742	0.00133	0.79225	0.01688	0.10011	0.00150		508	23	592	10	615	9		-3.74%	615	9
13 FR	10	29	0.	0.05535	0.00	0.42089	0.01	0.05517	0.00		426	32	357	8	346	6		3.18%	34	6

52-09	8	1	37		163		128		092										6	
13FR52-10	29	109	0.27	0.07874	0.00208	2.18217	0.05255	0.20106	0.00365		1166	22	1175	17	1181	20		-1.27%	1166	22
13FR52-11	60	152	0.39	0.15755	0.00367	9.59402	0.16954	0.44165	0.00670		2430	40	2397	16	2358	30		3.05%	2430	40
13FR52-12	25	40	0.61	0.06109	0.00472	0.93716	0.06610	0.11130	0.00428		642	87	671	35	680	25		-1.32%	680	25
13FR52-13	326	1147	0.28	0.05068	0.00086	0.35429	0.00553	0.05072	0.00064		226	16	308	4	319	4		-3.45%	319	4
13FR52-14	37	434	0.09	0.05505	0.00158	0.57675	0.01510	0.07601	0.00126		414	31	462	10	472	8		-2.12%	472	8
13FR52-15	49	169	0.29	0.05635	0.00194	0.61724	0.01941	0.07947	0.00150		466	38	488	12	493	9		-1.01%	493	9
13FR52-16	60	136	0.44	0.05641	0.00212	0.59320	0.02047	0.07628	0.00151		469	43	473	13	474	9		-0.21%	474	9
13FR52-17	69	169	0.41	0.05383	0.00216	0.41752	0.01527	0.05627	0.00116		364	46	354	11	353	7		0.28%	353	7
13FR52-18	52	98	0.53	0.06005	0.00255	0.71241	0.02756	0.08607	0.00193		605	46	546	16	532	11		2.63%	532	11
13FR52-19	186	345	0.54	0.05412	0.00152	0.39267	0.01010	0.05263	0.00085		376	30	336	7	331	5		1.51%	331	5
13	1	2	0	0.05	0.	0.43	0.	0.05	0.		450	3	370	9	357	6		3.6	3	6

FR52-20	17	07	.56	593	00186	902	01330	694	00104			6						4%	57	
13FR52-21	50	181	0.28	0.05658	0.00309	0.62290	0.03182	0.07985	0.00153		475	124	492	20	495	9		-0.61%	495	9
13FR52-22	40	117	0.34	0.05481	0.00228	0.59842	0.02283	0.07921	0.00170		404	48	476	15	491	10		-3.05%	491	10
13FR52-23	83	143	0.58	0.13705	0.00171	7.34841	0.08542	0.38895	0.00528		2190	11	2155	10	2118	25		3.40%	2190	11
13FR52-24	331	364	0.91	0.06024	0.00203	0.79393	0.02439	0.09562	0.00183		612	35	593	14	589	11		0.68%	589	11
13FR52-25	133	505	0.26	0.05782	0.00117	0.57658	0.01064	0.07234	0.00100		523	19	462	7	450	6		2.67%	450	6
13FR52-26	117	207	0.56	0.05635	0.00165	0.61435	0.01644	0.07909	0.00133		466	31	486	10	491	8		-1.02%	491	8
13FR52-27	104	156	0.67	0.07619	0.00185	2.06253	0.04586	0.19637	0.00332		1100	21	1136	15	1156	18		-4.84%	1100	21
13FR52-28	44	71	0.62	0.12133	0.00247	6.07912	0.11409	0.36346	0.00641		1976	15	1987	16	1999	30		-1.15%	1976	15
13FR52-29	50	92	0.54	0.05866	0.00262	0.75395	0.03086	0.09324	0.00215		555	50	571	18	575	13		-0.70%	575	13
13FR52-30	83	265	0.31	0.11656	0.00224	4.49336	0.06508	0.27958	0.00352		1904	35	1730	12	1589	18		19.82%		

13FR52-31	81	505	0.16	0.11914	0.00098	5.88898	0.04598	0.35855	0.00409		1943	10	1960	7	1975	19		-1.62%	1943	10
13FR52-32	132	176	0.75	0.06137	0.00168	0.91299	0.02281	0.10792	0.00181		652	27	659	12	661	11		-0.30%	661	11
13FR52-33	123	293	0.42	0.05297	0.00156	0.40650	0.01099	0.05566	0.00092		328	33	346	8	349	6		-0.86%	349	6
13FR52-34	94	164	0.57	0.05709	0.00196	0.57761	0.01815	0.07339	0.00137		495	38	463	12	457	8		1.31%	457	8
13FR52-35	52	110	0.47	0.05722	0.00206	0.68220	0.02243	0.08649	0.00170		500	39	528	14	535	10		-1.31%	535	10
13FR52-36	57	187	0.31	0.05607	0.00176	0.59928	0.01720	0.07753	0.00137		455	34	477	11	481	8		-0.83%	481	8
13FR52-37	66	108	0.61	0.13059	0.00199	7.02280	0.09924	0.39008	0.00583		2106	12	2114	13	2123	27		-0.80%	2106	12
13FR52-38	126	286	0.44	0.05215	0.00162	0.40570	0.01157	0.05643	0.00096		292	35	346	8	354	6		-2.26%	354	6
13FR52-39	118	135	0.87	0.05970	0.00213	0.74753	0.02436	0.09082	0.00179		593	38	567	14	560	11		1.25%	560	11
13FR52-40	80	99	0.81	0.05669	0.00268	0.81034	0.03505	0.10369	0.00253		479	54	603	20	636	15		-5.19%	636	15
13FR52-	58	237	0.25	0.05093	0.00173	0.40340	0.01259	0.05745	0.00102		238	40	344	9	360	6		-4.44%	360	6

41																				
13FR52-42	62	150	0.42	0.05711	0.00202	0.63727	0.02053	0.08093	0.00156		496	39	501	13	502	9		-0.20%	502	9
13FR52-43	75	126	0.60	0.05921	0.00210	0.65145	0.02110	0.07981	0.00154		575	38	509	13	495	9		2.83%	495	9
13FR52-44	44	124	0.36	0.05697	0.00205	0.60429	0.01989	0.07694	0.00150		490	40	480	13	478	9		0.42%	478	9
13FR52-45	37	38	0.98	0.10582	0.00284	4.26257	0.10432	0.29217	0.00592		1729	20	1686	20	1652	30		4.66%	1729	20
13FR52-46	61	45	1.35	0.11561	0.00269	5.29397	0.11282	0.33214	0.00627		1889	17	1868	18	1849	30		2.16%	1889	17
13FR52-47	114	230	0.50	0.05192	0.00176	0.40109	0.01246	0.05603	0.00100		282	40	342	9	351	6		-2.56%	351	6
13FR52-48	30	122	0.25	0.05355	0.00246	0.43772	0.01844	0.05929	0.00133		352	56	369	13	371	8		-0.54%	371	8
13FR52-49	138	242	0.57	0.04989	0.00196	0.38533	0.01395	0.05602	0.00111		190	48	331	10	351	7		-5.70%	351	7
13FR52-50	140	311	0.45	0.05355	0.00152	0.41736	0.01086	0.05654	0.00091		352	31	354	8	355	6		-0.28%	355	6
13FR52-51	35	104	0.34	0.05550	0.00243	0.60256	0.02424	0.07875	0.00174		432	51	479	15	489	10		-2.04%	489	10
13FR52	53	73	0.7	0.10832	0.0020	5.18906	0.0897	0.34748	0.0055		1771	14	1851	15	1923	27		-7.90%	177	14

-52			2		2		0		9										1	
13FR52-53	61	103	0.59	0.05908	0.00223	0.75208	0.02591	0.09233	0.00188		570	41	569	15	569	11		0.00%	569	11
13FR52-54	50	55	0.91	0.12706	0.00250	6.53296	0.11857	0.37293	0.00647		2058	14	2050	16	2043	30		0.73%	2058	14
13FR52-55	52	98	0.53	0.06054	0.00288	0.70646	0.03061	0.08464	0.00206		623	53	543	18	524	12		3.63%	524	12
13FR52-56	53	145	0.37	0.05711	0.00280	0.63658	0.02850	0.08084	0.00200		496	56	500	18	501	12		-0.20%	501	12
13FR52-57	51	376	0.14	0.05618	0.00128	0.58414	0.01222	0.07541	0.00110		459	23	467	8	469	7		-0.43%	469	7
13FR52-58	61	82	0.74	0.05777	0.00242	0.64958	0.02488	0.08156	0.00177		521	47	508	15	505	11		0.59%	505	11
13FR52-59	72	179	0.40	0.05672	0.00193	0.61827	0.01925	0.07906	0.00148		481	37	489	12	491	9		-0.41%	491	9
13FR52-60	154	338	0.45	0.06581	0.00120	1.13152	0.01895	0.12470	0.00170		800	16	768	9	758	10		1.32%	758	10
13FR52-61	75	165	0.45	0.11251	0.00343	4.87586	0.12614	0.31431	0.00509		1840	57	1798	22	1762	25		4.43%	1840	57
13FR52-62	65	97	0.67	0.07585	0.00209	1.95739	0.04913	0.18717	0.00340		1091	24	1101	17	1106	18		-1.36%	1091	24
13FR	72	18	0.	0.11374	0.00	2.63787	0.06	0.16821	0.00		1860	58	1311	19	1002	16		85.63		

52-63		9	38		355		946		283									%		
13FR52-64	37	66	0.56	0.05769	0.00319	0.62441	0.03149	0.07850	0.00214		518	64	493	20	487	13		1.23%	487	13
13FR52-65	77	259	0.30	0.05875	0.00149	0.70221	0.01631	0.08670	0.00136		558	25	540	10	536	8		0.75%	536	8
13FR52-66	54	172	0.32	0.05771	0.00175	0.63639	0.01762	0.07998	0.00138		519	32	500	11	496	8		0.81%	496	8
13FR52-67	100	366	0.27	0.05819	0.00119	0.79005	0.01483	0.09848	0.00137		537	20	591	8	605	8		-2.31%	605	8
13FR52-68	105	46	2.26	0.05772	0.00408	0.62251	0.04064	0.07823	0.00250		519	88	491	25	486	15		1.03%	486	15
13FR52-69	87	407	0.21	0.16615	0.00200	9.91445	0.11146	0.43278	0.00590		2519	10	2427	10	2318	27		8.67%	2519	10
13FR52-70	78	281	0.28	0.05613	0.00159	0.61896	0.01611	0.07998	0.00132		458	30	489	10	496	8		-1.41%	496	8
13FR52-71	137	109	1.26	0.18298	0.00213	13.11989	0.14601	0.52002	0.00716		2680	10	2688	10	2699	30		-0.70%	2680	10
13FR52-72	35	72	0.49	0.10218	0.00276	4.02474	0.09918	0.28566	0.00574		1664	21	1639	20	1620	29		2.72%	1664	21
13FR52-73	7	27	0.26	0.06077	0.00931	0.63096	0.09195	0.07530	0.00354		631	348	497	57	468	21		6.20%	468	21
13	5	1	0	0.05	0.	0.64	0.	0.08	0.		425	3	506	1	524	9		-	5	9

FR52-74	7	87	.30	531	00168	644	01807	476	00145			3		1				3.44%	24	
13FR52-75	29	96	0.30	0.05399	0.00392	0.59671	0.03980	0.08016	0.00272		371	90	475	25	497	16		-4.43%	497	16
13FR52-76	72	305	0.24	0.05632	0.00125	0.60399	0.01234	0.07778	0.00112		465	22	480	8	483	7		-0.62%	483	7
13FR52-77	118	149	0.79	0.06077	0.00169	0.81512	0.02065	0.09728	0.00162		631	28	605	12	598	10		1.17%	598	10
13FR52-78	66	106	0.63	0.05850	0.00229	0.62942	0.02243	0.07804	0.00162		549	43	496	14	484	10		2.48%	484	10
13FR52-79	153	372	0.41	0.05253	0.00172	0.41809	0.01256	0.05772	0.00102		309	38	355	9	362	6		-1.93%	362	6
13FR52-80	199	441	0.45	0.05508	0.00127	0.42857	0.00902	0.05643	0.00081		415	23	362	6	354	5		2.26%	354	5
13FR52-81	55	104	0.53	0.06376	0.00216	0.93269	0.02882	0.10609	0.00205		734	34	669	15	650	12		2.92%	650	12
13FR52-82	45	104	0.44	0.08274	0.00215	1.59118	0.03714	0.13947	0.00244		1263	22	967	15	842	14		14.85%		
13FR52-83	20	35	0.57	0.12562	0.00320	6.27592	0.14681	0.36234	0.00750		2038	18	2015	20	1993	35		2.26%	2038	18
13FR52-84	43	415	0.10	0.05895	0.00112	0.71530	0.01243	0.08800	0.00118		565	18	548	7	544	7		0.74%	544	7

13FR52-85	755	746	1.01	0.05792	0.00117	0.58702	0.01088	0.07350	0.00101		527	19	469	7	457	6		2.63%	457	6
13FR52-86	14	23	0.59	0.06131	0.00482	0.77288	0.05589	0.09143	0.00336		650	93	581	32	564	20		3.01%	564	20
13FR52-87	31	89	0.35	0.05290	0.00245	0.56270	0.02391	0.07715	0.00176		325	56	453	16	479	11		-5.43%	479	11
13FR52-88	97	160	0.61	0.05374	0.00197	0.41593	0.01399	0.05613	0.00107		360	43	353	10	352	7		0.28%	352	7
13FR52-89	24	44	0.55	0.13044	0.00725	6.30511	0.31903	0.35055	0.01453		2104	40	2019	44	1937	69		8.62%	2104	40
13FR52-90	332	646	0.51	0.05926	0.00105	0.63301	0.01032	0.07747	0.00101		577	16	498	6	481	6		3.53%	481	6
13FR52-91	127	301	0.42	0.05217	0.00138	0.41752	0.01015	0.05805	0.00089		293	29	354	7	364	5		-2.75%	364	5
13FR52-92	162	296	0.55	0.05311	0.00148	0.41545	0.01062	0.05673	0.00090		333	31	353	8	356	5		-0.84%	356	5
13FR52-93	153	343	0.45	0.05121	0.00135	0.39573	0.00961	0.05604	0.00085		250	29	339	7	351	5		-3.42%	351	5
13FR52-94	71	277	0.25	0.18317	0.00150	13.02458	0.10265	0.51570	0.00600		2682	10	2681	7	2681	26		0.04%	2682	10
13FR52-	191	359	0.53	0.05175	0.00135	0.41289	0.00988	0.05786	0.00088		274	29	351	7	363	5		-3.31%	363	5

95																				
13FR52-96	33	36	0.92	0.05905	0.00405	0.64556	0.04062	0.07929	0.00254		569	82	506	25	492	15		2.85%	492	15
13FR52-97	52	91	0.57	0.05897	0.00234	0.71042	0.02571	0.08737	0.00184		566	44	545	15	540	11		0.93%	540	11
13FR52-98	121	296	0.41	0.05462	0.00138	0.41969	0.00973	0.05572	0.00084		397	27	356	7	350	5		1.71%	350	5
13FR52-99	46	151	0.31	0.05744	0.00164	0.62237	0.01631	0.07857	0.00130		508	30	491	10	488	8		0.61%	488	8
13FR52-100	50	228	0.22	0.05889	0.00125	0.81588	0.01594	0.10048	0.00143		563	20	606	9	617	8		-1.78%	617	8
MO15-01	64	217	0.30	0.05993	0.00173	0.07745	0.00159	0.64010	0.01691		601	26	481	10	502	10		4.37%	481	10
MO15-02	228	249	0.92	0.06350	0.00137	0.09760	0.00185	0.85453	0.01674		725	19	600	11	627	9		4.50%	600	11
MO15-03	121	184	0.66	0.13145	0.00196	0.38275	0.00714	6.93720	0.09470		2117	16	2089	33	2103	12		1.34%	2117	16
MO15-04	114	339	0.34	0.05501	0.00239	0.05384	0.00133	0.40839	0.01621		413	47	338	8	348	12		2.96%	338	8
MO15-05	41	80	0.52	0.05973	0.00341	0.08700	0.00263	0.71657	0.03762		594	63	538	16	549	22		2.04%	538	16
MO15-06	125	370	0.34	0.06385	0.00144	0.10185	0.00196	0.89669	0.01832		737	19	625	11	650	10		4.00%	625	11
MO1	39	86	0.	0.06668	0.00	0.06594	0.00	0.60627	0.02		828	46	412	11	481	16		16.75		

5-07			45		311		176		570									%		
MO15-08	82	79	1.04	0.10834	0.00299	0.31411	0.00759	4.69211	0.11961		1772	21	1761	37	1766	21		0.62%	1772	21
MO15-09	72	178	0.41	0.05462	0.00245	0.05601	0.00140	0.42181	0.01744		397	50	351	9	357	12		1.71%	351	9
MO15-10	225	362	0.62	0.06318	0.00126	0.10154	0.00189	0.88457	0.01598		714	18	623	11	643	9		3.21%	623	11
MO15-11	79	128	0.61	0.05901	0.00249	0.08820	0.00219	0.71760	0.02790		567	44	545	13	549	16		0.73%	545	13
MO15-12	222	465	0.48	0.05384	0.00149	0.05698	0.00114	0.42301	0.01068		364	26	357	7	358	8		0.28%	357	7
MO15-13	233	309	0.75	0.05876	0.00146	0.08757	0.00171	0.70950	0.01603		558	22	541	10	544	10		0.55%	541	10
MO15-14	184	234	0.79	0.06429	0.00155	0.10967	0.00216	0.97221	0.02133		751	21	671	13	690	11		2.83%	671	13
MO15-15	44	364	0.12	0.05731	0.00154	0.07753	0.00155	0.61262	0.01498		503	24	481	9	485	9		0.83%	481	9
MO15-16	112	157	0.71	0.09553	0.00183	0.26266	0.00514	3.45945	0.06046		1539	16	1503	26	1518	14		2.40%	1539	16
MO15-17	101	210	0.48	0.05825	0.00155	0.08733	0.00174	0.70134	0.01703		539	24	540	10	540	10		0.00%	540	10
MO15-18	89	215	0.42	0.05561	0.00235	0.05502	0.00134	0.42185	0.01634		437	45	345	8	357	12		3.48%	345	8
MO15-19	243	226	1.07	0.07174	0.00152	0.13575	0.00260	1.34273	0.02569		979	18	821	15	864	11		5.24%	821	15
MO15-20	84	191	0.44	0.06264	0.00284	0.08614	0.00225	0.74398	0.03097		696	47	533	13	565	18		6.00%	533	13

MO15-21	348	384	0.90	0.06131	0.00121	0.09229	0.00170	0.78005	0.01398		650	18	569	10	586	8		2.99%	569	10
MO15-22	30	504	0.06	0.18408	0.00235	0.51470	0.00935	13.06228	0.15348		2690	15	2677	40	2684	11		0.49%	2690	15
MO15-23	129	283	0.46	0.05395	0.00194	0.05300	0.00117	0.39421	0.01305		369	38	333	7	337	10		1.20%	333	7
MO15-24	119	360	0.33	0.06138	0.00144	0.10423	0.00202	0.88205	0.01878		653	20	639	12	642	10		0.47%	639	12
MO15-25	122	253	0.48	0.06045	0.00163	0.09657	0.00196	0.80480	0.01984		620	24	594	12	600	11		1.01%	594	12
MO15-26	163	251	0.65	0.05389	0.00200	0.05467	0.00123	0.40615	0.01381		366	39	343	8	346	10		0.87%	343	8
MO15-27	56	85	0.65	0.10961	0.00408	0.31582	0.00935	4.77225	0.16469		1793	28	1769	46	1780	29		1.36%	1793	28
MO15-28	173	341	0.51	0.05537	0.00193	0.05264	0.00116	0.40186	0.01284		427	35	331	7	343	9		3.63%	331	7
MO15-29	220	462	0.48	0.05600	0.00393	0.05080	0.00177	0.39223	0.02515		452	82	319	11	336	18		5.33%	319	11
MO15-30	118	97	1.22	0.11749	0.00222	0.25953	0.00514	4.20363	0.07136		1837	58	1478	27	1632	20		24.29%		
MO15-31	84	222	0.38	0.05970	0.00165	0.07905	0.00161	0.65064	0.01634		593	25	490	10	509	10		3.88%	490	10
MO15-32	170	456	0.37	0.05202	0.00134	0.05452	0.00105	0.39095	0.00919		286	24	342	6	335	7		-2.05%	342	6
MO15-33	54	194	0.28	0.05759	0.00202	0.08624	0.00194	0.68467	0.02199		514	35	533	12	530	13		-0.56%	533	12
MO1	10	23	0.	0.05673	0.00	0.05423	0.00	0.42407	0.01		481	33	340	7	359	9		5.59%	34	7

5-34	7	6	45		190		117		298										0	
MO15-35	101	272	0.37	0.05457	0.00179	0.05524	0.00118	0.41556	0.01247		395	33	347	7	353	9		1.73%	347	7
MO15-36	63	104	0.61	0.06022	0.00213	0.09831	0.00224	0.81614	0.02647		611	34	604	13	606	15		0.33%	604	13
MO15-37	65	154	0.42	0.10506	0.00199	0.18987	0.00368	2.75007	0.04626		1636	52	1115	20	1306	14		46.73%		
MO15-38	77	189	0.41	0.05824	0.00241	0.05600	0.00134	0.44961	0.01704		539	43	351	8	377	12		7.41%	351	8
MO15-39	80	29	2.78	0.05679	0.00600	0.07633	0.00339	0.59760	0.05926		483	142	474	20	476	38		0.42%	474	20
MO15-40	26	65	0.40	0.05748	0.00353	0.08475	0.00266	0.67154	0.03807		510	71	524	16	522	23		-0.38%	524	16
MO15-41	150	186	0.81	0.05906	0.00185	0.07871	0.00168	0.64076	0.01838		569	30	488	10	503	11		3.07%	488	10
MO15-42	50	116	0.43	0.06068	0.00232	0.08977	0.00210	0.75093	0.02636		628	38	554	12	569	15		2.71%	554	12
MO15-43	47	72	0.65	0.05990	0.00297	0.08833	0.00239	0.72937	0.03333		600	54	546	14	556	20		1.83%	546	14
MO15-44	42	75	0.56	0.13443	0.00298	0.38612	0.00866	7.15529	0.14729		2157	17	2105	40	2131	18		2.47%	2157	17
MO15-45	32	61	0.53	0.05807	0.00322	0.10362	0.00293	0.82953	0.04291		532	65	636	17	613	24		-3.62%	636	17
MO15-46	55	30	1.83	0.11928	0.00419	0.34747	0.01011	5.71346	0.18668		1945	26	1923	48	1933	28		1.14%	1945	26
MO15-47	27	43	0.63	0.13381	0.00325	0.38061	0.00895	7.02050	0.15826		2149	18	2079	42	2114	20		3.37%	2149	18

MO15-48	138	267	0.52	0.05720	0.00214	0.07486	0.00172	0.59030	0.02029		499	38	465	10	471	13		1.29%	465	10
MO15-49	41	104	0.39	0.06861	0.00291	0.07342	0.00189	0.69446	0.02662		887	40	457	11	535	16		17.07%		
MO15-50	140	190	0.74	0.05426	0.00231	0.06067	0.00145	0.45383	0.01786		382	48	380	9	380	12		0.00%	380	9
MO15-51	57	70	0.81	0.05964	0.00389	0.09243	0.00314	0.75991	0.04548		591	73	570	19	574	26		0.70%	570	19
MO15-52	33	65	0.51	0.13010	0.00274	0.37915	0.00822	6.79973	0.13236		2099	17	2072	38	2086	17		1.30%	2099	17
MO15-53	77	175	0.44	0.06013	0.00219	0.07655	0.00175	0.63453	0.02119		608	36	475	10	499	13		5.05%	475	10
MO15-54	175	235	0.75	0.05953	0.00199	0.09346	0.00208	0.76695	0.02340		587	32	576	12	578	13		0.35%	576	12
MO15-55	54	140	0.39	0.05964	0.00242	0.09595	0.00236	0.78875	0.02940		591	41	591	14	590	17		-0.17%	591	14
MO15-56	47	150	0.32	0.05740	0.00259	0.07816	0.00201	0.61844	0.02560		507	48	485	12	489	16		0.82%	485	12
MO15-57	50	176	0.28	0.06743	0.00227	0.11514	0.00265	1.07025	0.03275		851	30	703	15	739	16		5.12%	703	15
MO15-58	71	149	0.47	0.05773	0.00353	0.05601	0.00172	0.44568	0.02508		520	71	351	10	374	18		6.55%	351	10
MO15-59	55	141	0.39	0.05760	0.00242	0.07402	0.00177	0.58771	0.02287		515	46	460	11	469	15		1.96%	460	11
MO15-60	135	294	0.46	0.05545	0.00196	0.05289	0.00114	0.40425	0.01323		430	37	332	7	345	10		3.92%	332	7
MO1	16	18	0.	0.06105	0.00	0.10641	0.00	0.89551	0.03		641	36	652	15	649	16		-0.4	65	15

5-61	2	0	90		229		253		072									6%	2	
MO15-62	27	46	0.59	0.05604	0.00618	0.07562	0.00343	0.58416	0.06056		454	151	470	21	467	39		-0.64%	470	21
MO15-63	64	236	0.27	0.05976	0.00212	0.07279	0.00162	0.59956	0.01956		595	35	453	10	477	12		5.30%	453	10
MO15-64	282	415	0.68	0.05546	0.00203	0.05129	0.00112	0.39210	0.01323		431	39	322	7	336	10		4.35%	322	7
MO15-65	42	85	0.49	0.05862	0.00289	0.08291	0.00217	0.66991	0.03061		553	56	513	13	521	19		1.56%	513	13
MO15-66	165	148	1.11	0.11349	0.00264	0.30819	0.00677	4.82114	0.10285		1856	18	1732	33	1789	18		7.16%	1856	18
MO15-67	122	266	0.46	0.05689	0.00182	0.05420	0.00115	0.42502	0.01243		487	31	340	7	360	9		5.88%	340	7
MO15-68	0	57	0.01	0.05383	0.00523	0.05012	0.00208	0.37188	0.03366		364	130	315	13	321	25		1.90%	315	13
MO15-69	73	113	0.65	0.05992	0.00257	0.08592	0.00217	0.70969	0.02793		601	44	531	13	545	17		2.64%	531	13
MO15-70	68	129	0.52	0.16867	0.00283	0.45897	0.00928	10.67105	0.16671		2544	16	2435	41	2495	15		4.48%	2544	16
MO15-71	124	267	0.46	0.05441	0.00181	0.05516	0.00117	0.41364	0.01263		388	34	346	7	351	9		1.45%	346	7
MO15-72	119	328	0.36	0.05386	0.00163	0.05404	0.00111	0.40118	0.01114		365	30	339	7	343	8		1.18%	339	7
MO15-73	46	188	0.25	0.19297	0.00273	0.52814	0.01005	14.04772	0.18550		2768	15	2734	42	2753	13		1.24%	2768	15
MO15-74	122	197	0.62	0.17927	0.00238	0.49823	0.00913	12.31142	0.14996		2646	15	2606	39	2628	11		1.53%	2646	15

MO15-75	85	227	0.37	0.05621	0.00176	0.07392	0.00153	0.57269	0.01649		461	31	460	9	460	11		0.00%	460	9
MO15-76	86	326	0.26	0.05936	0.00152	0.09433	0.00186	0.77181	0.01806		580	23	581	11	581	10		0.00%	581	11
MO15-77	206	655	0.32	0.05686	0.00112	0.07880	0.00144	0.61759	0.01106		486	18	489	9	488	7		-0.20%	489	9
MO15-78	69	352	0.20	0.05831	0.00149	0.07957	0.00157	0.63949	0.01491		541	23	494	9	502	9		1.62%	494	9
MO15-79	111	292	0.38	0.05552	0.00158	0.07181	0.00146	0.54954	0.01430		433	27	447	9	445	9		-0.45%	447	9
MO15-80	47	101	0.47	0.07097	0.00211	0.14757	0.00323	1.44360	0.03912		957	25	887	18	907	16		2.25%	887	18
MO15-81	100	298	0.33	0.05475	0.00179	0.05430	0.00115	0.40975	0.01230		402	33	341	7	349	9		2.35%	341	7
MO15-82	48	109	0.44	0.21746	0.00325	0.55919	0.01107	16.7610	0.23663		2962	15	2863	46	2921	14		3.46%	2962	15
MO15-83	46	83	0.56	0.07745	0.00227	0.19582	0.00435	2.09040	0.05613		1133	24	1153	23	1146	18		-1.73%	1133	24
MO15-84	34	44	0.76	0.06173	0.00432	0.08907	0.00298	0.75793	0.04932		665	83	550	18	573	28		4.18%	550	18
MO15-85	37	219	0.17	0.05997	0.00160	0.10374	0.00208	0.85747	0.02093		602	24	636	12	629	11		-1.10%	636	12
MO15-86	60	317	0.19	0.05809	0.00148	0.07990	0.00157	0.63972	0.01480		533	23	496	9	502	9		1.21%	496	9
MO15-87	17	187	0.09	0.06085	0.00193	0.09130	0.00196	0.76578	0.02227		634	30	563	12	577	13		2.49%	563	12
MO1	58	83	0.	0.05523	0.00	0.05309	0.00	0.40417	0.00		422	19	333	6	345	6		3.60%	33	6

5-88	7	1	71		116		098		768										3	
MO15-89	33	232	0.14	0.06101	0.00176	0.08631	0.00177	0.72584	0.01919		640	26	534	11	554	11		3.75%	534	11
MO15-90	72	115	0.63	0.13005	0.00238	0.38124	0.00771	6.83418	0.11535		2099	16	2082	36	2090	15		0.82%	2099	16
MO15-91	37	208	0.18	0.06375	0.00163	0.11537	0.00232	1.01378	0.02360		733	22	704	13	711	12		0.99%	704	13
MO15-92	63	442	0.14	0.07277	0.00119	0.16697	0.00299	1.67479	0.02458		1008	16	995	17	999	9		0.40%	995	17
MO15-93	101	217	0.46	0.12855	0.00209	0.34922	0.00667	6.18800	0.09153		2078	16	1931	32	2003	13		7.61%	2078	16
MO15-94	127	83	1.52	0.06329	0.00330	0.08799	0.00252	0.76757	0.03668		718	55	544	15	578	21		6.25%	544	15
MO15-95	120	570	0.21	0.05804	0.00145	0.06947	0.00135	0.55575	0.01262		531	22	433	8	449	8		3.70%	433	8
MO15-96	25	92	0.28	0.07048	0.00429	0.07184	0.00225	0.69791	0.03901		879	140	446	13	524	24		17.49%		
MO15-97	62	337	0.18	0.07641	0.00165	0.11533	0.00223	1.21473	0.02353		1065	57	702	13	795	11		13.25%		
MO15-98	237	394	0.60	0.06250	0.00145	0.09864	0.00190	0.84982	0.01795		691	20	606	11	625	10		3.14%	606	11
MO15-99	55	81	0.68	0.06461	0.00333	0.08771	0.00247	0.78117	0.03704		762	54	542	15	586	21		8.12%	542	15
MO15-100	289	402	0.72	0.05848	0.00222	0.06580	0.00154	0.53043	0.01837		548	38	411	9	432	12		5.11%	411	9
MO1	32	89	0.	0.05633	0.00	0.07724	0.00	0.60006	0.01		465	19	480	9	477	7		-0.6	48	9

6-01	7	2	37		110		148		073									2%	0	
MO16-02	246	441	0.56	0.11950	0.00199	0.32161	0.00642	5.30018	0.08156		1949	17	1798	31	1869	13		8.40%	1949	17
MO16-03	296	632	0.47	0.05871	0.00158	0.07375	0.00153	0.59712	0.01479		556	24	459	9	475	9		3.49%	459	9
MO16-04	348	280	1.24	0.11592	0.00225	0.31088	0.00654	4.96976	0.08887		1894	17	1745	32	1814	15		8.54%	1894	17
MO16-05	59	179	0.33	0.05635	0.00236	0.07938	0.00196	0.61689	0.02389		466	45	492	12	488	15		-0.81%	492	12
MO16-06	44	81	0.53	0.12734	0.00306	0.25981	0.00600	4.56252	0.09908		2041	60	1486	30	1731	20		37.35%		
MO16-07	50	150	0.34	0.06148	0.00287	0.08283	0.00228	0.70220	0.02997		656	47	513	14	540	18		5.26%	513	14
MO16-08	70	302	0.23	0.05573	0.00239	0.05304	0.00129	0.40768	0.01625		442	47	333	8	347	12		4.20%	333	8
MO16-09	97	550	0.18	0.06362	0.00159	0.08080	0.00167	0.70888	0.01616		729	22	501	10	544	10		8.58%	501	10
MO16-10	165	259	0.64	0.13354	0.00233	0.39523	0.00817	7.27841	0.11851		2145	17	2147	38	2146	15		-0.09%	2145	17
MO16-11	15	96	0.16	0.06111	0.00331	0.08135	0.00233	0.68551	0.03443		599	128	503	14	521	21		3.58%	503	14
MO16-12	139	641	0.22	0.05322	0.00140	0.05252	0.00107	0.38538	0.00937		338	25	330	7	331	7		0.30%	330	7
MO16-13	90	88	1.03	0.06215	0.00277	0.10817	0.00290	0.92705	0.03803		679	45	662	17	666	20		0.60%	662	17
MO16-14	50	68	0.74	0.05831	0.00416	0.07793	0.00244	0.62670	0.04225		541	93	484	15	494	26		2.07%	484	15

MO16-15	198	477	0.42	0.05428	0.00153	0.05790	0.00121	0.43339	0.01127		383	27	363	7	366	8		0.83%	363	7
MO16-16	51	338	0.15	0.05985	0.00145	0.08701	0.00177	0.71816	0.01602		598	22	538	10	550	9		2.23%	538	10
MO16-17	104	278	0.37	0.06073	0.00147	0.10131	0.00205	0.84841	0.01901		630	22	622	12	624	10		0.32%	622	12
MO16-18	138	105	1.31	0.06843	0.00368	0.10915	0.00338	1.02998	0.05074		882	54	668	20	719	25		7.63%	668	20
MO16-19	95	252	0.38	0.08230	0.00186	0.20533	0.00432	2.33038	0.04836		1253	19	1204	23	1222	15		4.07%	1253	19
MO16-20	74	252	0.29	0.06107	0.00196	0.07425	0.00166	0.62529	0.01840		642	30	462	10	493	11		6.71%	462	10
MO16-21	171	244	0.70	0.06012	0.00220	0.07530	0.00177	0.62421	0.02104		608	36	468	11	492	13		5.13%	468	11
MO16-22	111	374	0.30	0.05898	0.00162	0.07748	0.00161	0.63009	0.01599		566	25	481	10	496	10		3.12%	481	10
MO16-23	38	124	0.31	0.05660	0.00268	0.08109	0.00211	0.63282	0.02793		476	53	503	13	498	17		-0.99%	503	13
MO16-24	149	228	0.65	0.11913	0.00190	0.33163	0.00650	5.44770	0.08032		1943	17	1846	31	1892	13		5.25%	1943	17
MO16-25	15	41	0.37	0.05904	0.00501	0.08152	0.00289	0.66368	0.05327		569	113	505	17	517	33		2.38%	505	17
MO16-26	46	68	0.68	0.06485	0.00402	0.09115	0.00284	0.81511	0.04699		769	70	562	17	605	26		7.65%	562	17
MO16-27	68	165	0.41	0.05977	0.00251	0.07871	0.00197	0.64865	0.02515		595	43	488	12	508	15		4.10%	488	12
MO1	13	25	0.	0.06949	0.00	0.15214	0.00	1.45787	0.03		913	22	913	18	913	14		0.00%	91	18

6-28	3	6	52		178		323		444										3	
MO16-29	71	111	0.64	0.11540	0.00264	0.31383	0.00706	4.99341	0.10539		1886	18	1760	35	1818	18		7.16%	1886	18
MO16-30	212	176	1.20	0.06243	0.00216	0.10083	0.00233	0.86805	0.02776		689	33	619	14	635	15		2.58%	619	14
MO16-31	72	201	0.36	0.06264	0.00221	0.09140	0.00213	0.78934	0.02564		696	33	564	13	591	15		4.79%		
MO16-32	198	1537	0.13	0.05393	0.00102	0.05697	0.00107	0.42360	0.00739		368	19	357	7	359	5		0.56%	357	7
MO16-33	87	251	0.34	0.13195	0.00207	0.36823	0.00725	6.69925	0.09748		2124	16	2021	34	2073	13		5.10%	2124	16
MO16-34	77	165	0.47	0.05372	0.00305	0.05861	0.00160	0.43408	0.02314		359	72	367	10	366	16		-0.27%	367	10
MO16-35	341	795	0.43	0.05595	0.00161	0.07309	0.00154	0.56386	0.01498		450	27	455	9	454	10		-0.22%	455	9
MO16-36	403	874	0.46	0.05938	0.00121	0.07475	0.00144	0.61199	0.01138		581	19	465	9	485	7		4.30%	465	9
MO16-37	67	218	0.31	0.05591	0.00215	0.08742	0.00206	0.67395	0.02399		449	40	540	12	523	15		-3.15%	540	12
MO16-38	64	195	0.33	0.06137	0.00239	0.08951	0.00217	0.75740	0.02723		652	39	553	13	573	16		3.62%		
MO16-39	73	185	0.39	0.05416	0.00283	0.05432	0.00147	0.40566	0.01968		378	62	341	9	346	14		1.47%	341	9
MO16-40	125	243	0.51	0.05820	0.00236	0.05549	0.00134	0.44529	0.01666		537	42	348	8	374	12		7.47%	348	8
MO16-41	43	181	0.24	0.05582	0.00256	0.07452	0.00186	0.57358	0.02457		445	53	463	11	460	16		-0.65%	463	11

MO16-42	114	75	1.51	0.06745	0.00467	0.06186	0.00211	0.57530	0.03668		852	77	387	13	461	24		19.12%		
MO16-43	123	240	0.51	0.05518	0.00225	0.05516	0.00131	0.41969	0.01587		420	44	346	8	356	11		2.89%	346	8
MO16-44	34	292	0.12	0.15098	0.00224	0.23855	0.00458	4.96558	0.06602		2326	40	1374	23	1795	11		69.29%		
MO16-45	55	226	0.24	0.05834	0.00187	0.07382	0.00163	0.59378	0.01754		543	31	459	10	473	11		3.05%	459	10
MO16-46	174	293	0.59	0.06077	0.00206	0.09244	0.00214	0.77447	0.02405		631	32	570	13	582	14		2.11%	570	13
MO16-47	204	256	0.80	0.05971	0.00155	0.09810	0.00203	0.80762	0.01928		593	23	603	12	601	11		-0.33%	603	12
MO16-48	111	129	0.86	0.10533	0.00186	0.27986	0.00557	4.06427	0.06595		1720	17	1591	28	1647	13		8.11%	1720	17
MO16-49	0	14	0.03	0.06578	0.01147	0.05356	0.00315	0.48575	0.08087		799	256	336	19	402	55		19.64%		
MO16-50	69	90	0.77	0.12530	0.00330	0.30359	0.00739	5.24459	0.12631		2033	20	1709	37	1860	21		18.96%		
MO16-51	70	76	0.93	0.13393	0.00298	0.37241	0.00852	6.87654	0.14205		2150	18	2041	40	2096	18		5.34%	2150	18
MO16-52	140	262	0.53	0.05393	0.00188	0.05414	0.00121	0.40249	0.01300		368	36	340	7	343	9		0.88%	340	7
MO16-53	1	241	0.00	0.06237	0.00174	0.11147	0.00239	0.95846	0.02449		687	25	681	14	682	13		0.15%	681	14
MO16-54	44	146	0.30	0.14032	0.00249	0.24782	0.00502	4.79411	0.07631		2222	46	1426	25	1779	14		55.82%		
MO1	10	20	0.	0.06238	0.00	0.09992	0.00	0.85929	0.02		687	30	614	13	630	14		2.61%	61	13

6-55	9	5	53		202		224		565										4	
MO16-56	89	237	0.37	0.05979	0.00210	0.07533	0.00174	0.62093	0.02007		596	34	468	10	490	13		4.70%	468	10
MO16-57	65	94	0.69	0.06746	0.00288	0.12554	0.00337	1.16765	0.04565		852	40	762	19	786	21		3.15%	762	19
MO16-58	96	169	0.57	0.05637	0.00280	0.06920	0.00179	0.53778	0.02503		467	59	431	11	437	17		1.39%	431	11
MO16-59	107	258	0.41	0.23329	0.00319	0.55014	0.01079	17.69393	0.22887		3075	16	2826	45	2973	12		8.81%	3075	16
MO16-60	34	254	0.13	0.05927	0.00191	0.07467	0.00165	0.61014	0.01807		577	30	464	10	484	11		4.31%	464	10
MO16-61	35	76	0.47	0.21613	0.00384	0.54074	0.01198	16.11155	0.27373		2952	17	2787	50	2883	16		5.92%	2952	17
MO16-62	283	235	1.21	0.06492	0.00184	0.09969	0.00213	0.89220	0.02317		772	25	613	12	648	12		5.71%	613	12
MO16-63	103	229	0.45	0.06323	0.00312	0.08177	0.00235	0.71278	0.03204		716	50	507	14	546	19		7.69%	507	14
MO16-64	69	230	0.30	0.12364	0.00224	0.33685	0.00690	5.74132	0.09582		2009	17	1871	33	1938	14		7.38%	2009	17
MO16-65	106	212	0.50	0.05971	0.00190	0.09211	0.00203	0.75825	0.02224		593	30	568	12	573	13		0.88%	568	12
MO16-66	106	629	0.17	0.05625	0.00131	0.07408	0.00146	0.57449	0.01234		462	21	461	9	461	8		0.00%	461	9
MO16-67	115	172	0.67	0.06313	0.00287	0.09805	0.00267	0.85328	0.03551		713	45	603	16	626	19		3.81%	603	16
MO16-68	93	110	0.85	0.06094	0.00273	0.09254	0.00243	0.77745	0.03214		637	46	571	14	584	18		2.28%	571	14

MO16-69	57	91	0.63	0.06001	0.00322	0.10071	0.00289	0.83316	0.04162		604	60	619	17	615	23		-0.65%	619	17
MO16-70	221	341	0.65	0.06078	0.00135	0.10070	0.00198	0.84380	0.01723		631	20	619	12	621	9		0.32%	619	12
MO16-71	143	336	0.43	0.06770	0.00194	0.14030	0.00309	1.30939	0.03431		859	24	846	17	850	15		0.47%	846	17
MO16-72	199	339	0.59	0.11556	0.00257	0.31445	0.00696	5.00915	0.10236		1889	18	1763	34	1821	17		7.15%	1889	18
MO16-73	70	73	0.96	0.13037	0.00397	0.36174	0.00990	6.50117	0.18361		2103	22	1990	47	2046	25		5.68%	2103	22
MO16-74	59	96	0.62	0.19092	0.00297	0.51041	0.01039	13.43345	0.19709		2750	16	2658	44	2711	14		3.46%	2750	16
MO16-75	80	150	0.53	0.05825	0.00264	0.09242	0.00231	0.74213	0.03148		539	51	570	14	564	18		-1.05%	570	14
MO16-76	53	95	0.56	0.06960	0.00267	0.13616	0.00347	1.30640	0.04595		917	35	823	20	849	20		3.16%	823	20
MO16-77	38	122	0.31	0.06475	0.00259	0.10202	0.00257	0.91066	0.03341		766	38	626	15	657	18		4.95%	626	15
MO16-78	107	200	0.54	0.12710	0.00211	0.25438	0.00499	4.45685	0.06677		2007	47	1454	25	1695	14		38.03%		
MO16-79	114	310	0.37	0.05450	0.00172	0.05695	0.00122	0.42786	0.01244		392	31	357	7	362	9		1.40%	357	7
MO16-80	416	543	0.77	0.05497	0.00136	0.05563	0.00111	0.42151	0.00955		411	23	349	7	357	7		2.29%	349	7
MO16-81	27	276	0.10	0.12366	0.00194	0.30926	0.00598	5.27170	0.07579		1995	43	1735	29	1856	12		14.99%		
MO1	17	13	1.	0.06321	0.00	0.09286	0.00	0.80905	0.02		715	36	572	13	602	16		5.24%	57	13

6-82	8	1	36		240		227		810										2	
MO16-83	41	308	0.13	0.05932	0.00157	0.08226	0.00170	0.67262	0.01631		579	24	510	10	522	10		2.35%	510	10
MO16-84	547	1440	0.38	0.05976	0.00100	0.07300	0.00134	0.60134	0.00923		595	18	454	8	478	6		5.29%	454	8
MO16-85	130	164	0.79	0.06036	0.00222	0.08590	0.00204	0.71469	0.02412		617	36	531	12	548	14		3.20%	531	12
MO16-86	60	139	0.43	0.05745	0.00225	0.08316	0.00200	0.65852	0.02372		509	40	515	12	514	15		-0.19%	515	12
MO16-87	73	279	0.26	0.05892	0.00180	0.08136	0.00177	0.66080	0.01851		564	28	504	11	515	11		2.18%	504	11
MO16-88	82	104	0.79	0.06191	0.00262	0.09984	0.00255	0.85207	0.03326		671	43	613	15	626	18		2.12%	613	15
MO16-89	167	300	0.55	0.06212	0.00156	0.09895	0.00203	0.84728	0.01952		678	22	608	12	623	11		2.47%	608	12
MO16-90	31	126	0.25	0.11420	0.00232	0.17606	0.00363	2.77147	0.05023		1790	52	1039	19	1312	14		72.28%	1790	52
MO16-91	29	118	0.25	0.05658	0.00235	0.07846	0.00189	0.61192	0.02361		475	45	487	11	485	15		-0.41%	487	11
MO16-92	102	260	0.39	0.05364	0.00199	0.05836	0.00132	0.43154	0.01488		356	40	366	8	364	11		-0.55%	366	8
MO16-93	670	829	0.81	0.06077	0.00109	0.09402	0.00175	0.78763	0.01293		631	18	579	10	590	7		1.90%	579	10
MO16-94	51	147	0.34	0.05491	0.00232	0.07224	0.00177	0.54676	0.02142		409	46	450	11	443	14		-1.56%	450	11
MO16-95	56	132	0.42	0.22288	0.00335	0.59355	0.01209	18.23467	0.26268		3002	16	3004	49	3002	14		-0.07%	3002	16

MO16-96	43	149	0.29	0.05719	0.00275	0.08155	0.00216	0.64289	0.02862		499	53	505	13	504	18		-0.20%	505	13
MO16-97	46	136	0.34	0.05715	0.00330	0.07306	0.00225	0.57550	0.03044		497	64	455	14	462	20		1.54%	455	14
MO16-98	49	248	0.20	0.12369	0.00182	0.33533	0.00634	5.71698	0.07728		2010	16	1864	31	1934	12		7.83%	2010	16
MO16-99	68	486	0.14	0.13425	0.00169	0.36671	0.00667	6.78568	0.07828		2154	17	2014	31	2084	10		6.95%	2154	17
MO16-100	155	174	0.89	0.06698	0.00225	0.09276	0.00215	0.85635	0.02612		686	107	569	13	593	19		4.22%	569	13
MO17-01	36	216	0.16	0.05786	0.00098	0.07333	0.00136	0.58501	0.00917		524	18	456	8	468	6		2.63%	456	8
MO17-02	91	392	0.23	0.18762	0.00184	0.51990	0.00922	13.44827	0.12260		2721	17	2699	39	2712	9		0.82%	2721	17
MO17-03	38	288	0.13	0.06038	0.00090	0.07882	0.00144	0.65609	0.00896		617	19	489	9	512	5		4.70%	489	9
MO17-04	55	52	1.06	0.06203	0.00186	0.10315	0.00223	0.88219	0.02450		675	27	633	13	642	13		1.42%	633	13
MO17-05	88	324	0.27	0.06038	0.00120	0.09313	0.00180	0.77525	0.01421		617	19	574	11	583	8		1.57%	574	11
MO17-06	13	25	0.52	0.07247	0.00265	0.12488	0.00287	1.24773	0.04277		999	35	759	16	822	19		8.30%	759	16
MO17-07	390	358	1.09	0.06273	0.00084	0.10360	0.00188	0.89600	0.01099		699	19	635	11	650	6		2.36%	635	11
MO17-08	68	341	0.20	0.14083	0.00149	0.38652	0.00693	7.50483	0.07368		2218	38	2103	32	2162	11		5.47%	2218	38

MO17-09	114	155	0.73	0.05834	0.00181	0.09586	0.00211	0.77102	0.02210		543	29	590	12	580	13		-1.69%	590	12
MO17-10	16	50	0.32	0.05387	0.00177	0.10013	0.00209	0.74361	0.02314		366	35	615	12	565	13		-8.13%	615	12
MO17-11	70	80	0.87	0.10763	0.00139	0.29890	0.00553	4.43517	0.05291		1760	17	1686	27	1719	10		4.39%	1760	17
MO17-12	43	151	0.28	0.05861	0.00114	0.08104	0.00154	0.65492	0.01178		553	19	502	9	512	7		1.99%	502	9
MO17-13	25	39	0.65	0.05694	0.00227	0.07707	0.00176	0.60496	0.02275		489	45	479	11	480	14		0.21%	479	11
MO17-14	205	190	1.08	0.06213	0.00097	0.08753	0.00162	0.74974	0.01070		679	18	541	10	568	6		4.99%	541	10
MO17-15	108	301	0.36	0.05371	0.00088	0.05713	0.00105	0.42306	0.00636		359	19	358	6	358	5		0.00%	358	6
MO17-16	349	417	0.84	0.06245	0.00077	0.10072	0.00181	0.86729	0.00980		690	20	619	11	634	5		2.42%	619	11
MO17-17	165	182	0.91	0.11572	0.00126	0.32403	0.00582	5.16981	0.05214		1891	18	1809	28	1848	9		4.53%	1891	18
MO17-18	23	34	0.68	0.06141	0.00236	0.10792	0.00246	0.91365	0.03302		654	41	661	14	659	18		-0.30%	661	14
MO17-19	48	54	0.89	0.06212	0.00162	0.10691	0.00220	0.91559	0.02216		678	23	655	13	660	12		0.76%	655	13
MO17-20	43	242	0.18	0.12334	0.00136	0.33769	0.00608	5.74215	0.05857		1978	40	1871	29	1922	11		5.72%	1978	40
MO17-21	163	287	0.57	0.06515	0.00092	0.10046	0.00183	0.90233	0.01173		779	19	617	11	653	6		5.83%	617	11
MO1	18	16	1.	0.05609	0.00	0.07511	0.00	0.58085	0.01		456	19	467	9	465	7		-0.4	46	9

7-22	0	1	12		106		142		014									3%	7	
MO17-23	192	342	0.56	0.12740	0.00128	0.36876	0.00653	6.47716	0.06033		2062	18	2024	31	2043	8		1.88%	2062	18
MO17-24	31	222	0.14	0.06166	0.00088	0.10099	0.00184	0.85858	0.01129		662	19	620	11	629	6		1.45%	620	11
MO17-25	84	289	0.29	0.05296	0.00132	0.05456	0.00110	0.39838	0.00914		327	23	342	7	340	7		-0.58%	342	7
MO17-26	365	753	0.49	0.05460	0.00072	0.05277	0.00095	0.39728	0.00481		396	20	332	6	340	3		2.41%	332	6
MO17-27	3	24	0.12	0.05963	0.00258	0.09268	0.00222	0.76186	0.03103		590	48	571	13	575	18		0.70%	571	13
MO17-28	331	319	1.04	0.06206	0.00084	0.10373	0.00188	0.88752	0.01106		676	19	636	11	645	6		1.42%	636	11
MO17-29	23	90	0.26	0.18356	0.00197	0.51910	0.00939	13.13709	0.13127		2685	17	2695	40	2690	9		-0.37%	2685	17
MO17-30	27	344	0.08	0.05531	0.00086	0.07681	0.00140	0.58572	0.00841		425	19	477	8	468	5		-1.89%	477	8
MO17-31	157	240	0.66	0.05872	0.00093	0.08900	0.00164	0.72051	0.01058		557	18	550	10	551	6		0.18%	550	10
MO17-32	156	493	0.32	0.05937	0.00080	0.07691	0.00139	0.62955	0.00781		581	19	478	8	496	5		3.77%	478	8
MO17-33	185	254	0.73	0.05715	0.00094	0.08093	0.00150	0.63762	0.00962		497	19	502	9	501	6		-0.20%	502	9
MO17-34	103	312	0.33	0.09841	0.00109	0.26902	0.00481	3.64974	0.03722		1594	19	1536	24	1560	8		3.78%	1594	19
MO17-35	112	371	0.30	0.05728	0.00117	0.07758	0.00150	0.61267	0.01146		502	19	482	9	485	7		0.62%	482	9

MO17-36	52	196	0.27	0.05670	0.00150	0.07568	0.00155	0.59161	0.01445		480	24	470	9	472	9		0.43%	470	9
MO17-37	132	335	0.39	0.05736	0.00093	0.05655	0.00104	0.44719	0.00666		505	18	355	6	375	5		5.63%	355	6
MO17-38	102	256	0.40	0.05816	0.00091	0.08242	0.00151	0.66093	0.00952		536	18	511	9	515	6		0.78%	511	9
MO17-39	178	386	0.46	0.05338	0.00090	0.05623	0.00104	0.41376	0.00647		345	19	353	6	352	5		-0.28%	353	6
MO17-40	50	216	0.23	0.05547	0.00094	0.08274	0.00153	0.63274	0.00992		431	19	512	9	498	6		-2.73%	512	9
MO17-41	35	276	0.13	0.06419	0.00127	0.09185	0.00178	0.81281	0.01468		748	18	566	11	604	8		6.71%	566	11
MO17-42	220	420	0.52	0.05749	0.00101	0.05677	0.00106	0.44999	0.00723		510	18	356	6	377	5		5.90%	356	6
MO17-43	78	206	0.38	0.05825	0.00111	0.07236	0.00137	0.58107	0.01018		539	19	450	8	465	7		3.33%	450	8
MO17-44	200	376	0.53	0.12361	0.00126	0.36984	0.00655	6.30244	0.05904		2009	18	2029	31	2019	8		-0.99%	2009	18
MO17-45	62	381	0.16	0.05987	0.00092	0.07782	0.00143	0.64231	0.00909		533	62	482	8	491	8		1.87%	482	8
MO17-46	103	200	0.52	0.05954	0.00106	0.09215	0.00173	0.75636	0.01237		587	18	568	10	572	7		0.70%	568	10
MO17-47	75	185	0.41	0.05625	0.00120	0.05625	0.00109	0.43619	0.00853		462	20	353	7	368	6		4.25%	353	7
MO17-48	160	307	0.52	0.05533	0.00096	0.05592	0.00104	0.42659	0.00676		426	19	351	6	361	5		2.85%	351	6
MO1	16	72	0.	0.05857	0.00	0.07123	0.00	0.57513	0.00		551	20	444	8	461	4		3.83%	44	8

7-49	9	3	23		076		128		682										4	
MO17-50	176	684	0.26	0.05876	0.00076	0.07624	0.00137	0.61764	0.00732		558	20	474	8	488	5		2.95%	474	8
MO17-51	46	105	0.44	0.05656	0.00128	0.08151	0.00160	0.63554	0.01334		474	21	505	10	500	8		-0.99%	505	10
MO17-52	139	361	0.38	0.06155	0.00090	0.07408	0.00135	0.62864	0.00840		659	19	461	8	495	5		7.38%	461	8
MO17-53	317	729	0.43	0.05408	0.00074	0.06058	0.00109	0.45163	0.00565		374	20	379	7	378	4		-0.26%	379	7
MO17-54	120	358	0.34	0.06343	0.00086	0.10336	0.00187	0.90393	0.01130		723	19	634	11	654	6		3.15%	634	11
MO17-55	55	115	0.48	0.05808	0.00148	0.07457	0.00150	0.59711	0.01410		533	23	464	9	475	9		2.37%	464	9
MO17-56	44	73	0.60	0.06054	0.00134	0.12282	0.00241	1.02504	0.02115		623	20	747	14	716	11		-4.15%	747	14
MO17-57	153	239	0.64	0.06039	0.00101	0.09693	0.00180	0.80694	0.01238		618	18	596	11	601	7		0.84%	596	11
MO17-58	37	49	0.75	0.05875	0.00235	0.08044	0.00186	0.65155	0.02437		558	43	499	11	509	15		2.00%	499	11
MO17-59	12	633	0.02	0.20660	0.00201	0.51569	0.00908	14.68812	0.13183		2879	16	2795	39	2680	9		3.01%	2879	16
MO17-60	293	749	0.39	0.05064	0.00085	0.05236	0.00096	0.36553	0.00572		224	19	329	6	316	4		-3.95%	329	6
MO17-61	203	207	0.98	0.06078	0.00097	0.09631	0.00177	0.80707	0.01187		631	18	593	10	601	7		1.35%	593	10
MO17-62	1238	1093	1.13	0.18311	0.00177	0.40288	0.00707	10.16995	0.09020		2461	59	2120	37	2298	25		16.08%		

MO17-63	57	142	0.40	0.05303	0.00183	0.05227	0.00111	0.38215	0.01238		330	38	328	7	329	9		0.30%	328	7
MO17-64	40	661	0.06	0.05942	0.00101	0.05499	0.00102	0.45049	0.00698		583	18	345	6	378	5		9.57%	345	6
MO17-65	74	261	0.28	0.06008	0.00094	0.07574	0.00139	0.62734	0.00902		606	18	471	8	494	6		4.88%	471	8
MO17-66	62	466	0.13	0.07621	0.00092	0.11261	0.00201	1.18309	0.01299		843	53	680	12	719	9		5.74%	680	12
MO17-67	49	127	0.39	0.05334	0.00151	0.05579	0.00113	0.41024	0.01080		343	28	350	7	349	8		-0.29%	350	7
MO17-68	54	137	0.39	0.05866	0.00132	0.07631	0.00148	0.61708	0.01294		555	20	474	9	488	8		2.95%	474	9
MO17-69	9	28	0.32	0.05829	0.00477	0.06531	0.00187	0.52477	0.04148		541	123	408	11	428	28		4.90%	408	11
MO17-70	17	22	0.79	0.06276	0.00410	0.10231	0.00288	0.88515	0.05525		700	85	628	17	644	30		2.55%	628	17
MO17-71	180	125	1.44	0.06167	0.00151	0.09248	0.00186	0.78616	0.01772		663	22	570	11	589	10		3.33%	570	11
MO17-72	64	91	0.70	0.05964	0.00144	0.09697	0.00192	0.79726	0.01789		591	22	597	11	595	10		-0.34%	597	11
MO17-73	109	146	0.75	0.06208	0.00103	0.10220	0.00190	0.87458	0.01338		677	18	627	11	638	7		1.75%	627	11
MO17-74	18	35	0.51	0.05610	0.00340	0.07344	0.00214	0.56793	0.03232		456	75	457	13	457	21		0.00%	457	13
MO17-75	43	45	0.96	0.13067	0.00188	0.37661	0.00722	6.78416	0.09027		2107	17	2060	34	2084	12		2.28%	2107	17
MO1	49	11	0.	0.18588	0.00	0.50302	0.00	12.8903	0.12		2706	17	2627	39	2672	9		3.01%	27	17

7-76		1	44		196		901	4	597										06	
MO17-77	125	402	0.31	0.05904	0.00078	0.07473	0.00134	0.60825	0.00737		569	20	465	8	482	5		3.66%	465	8
MO17-78	32	44	0.72	0.15237	0.00203	0.41313	0.00783	8.67812	0.10706		2373	17	2229	36	2305	11		6.46%	2373	17
MO17-79	16	32	0.50	0.12469	0.00331	0.27962	0.00655	4.80648	0.11738		2024	19	1589	33	1786	21		27.38%		
MO17-80	49	291	0.17	0.05834	0.00121	0.07298	0.00140	0.58693	0.01119		543	19	454	8	469	7		3.30%	454	8
MO17-81	163	479	0.34	0.05636	0.00072	0.07423	0.00132	0.57671	0.00677		467	20	462	8	462	4		0.00%	462	8
MO17-82	52	156	0.33	0.05914	0.00109	0.06424	0.00120	0.52375	0.00888		572	18	401	7	428	6		6.73%	401	7
MO17-83	100	241	0.42	0.05697	0.00083	0.08822	0.00160	0.69283	0.00925		490	19	545	9	534	6		-2.02%	545	9
MO17-84	44	105	0.42	0.05738	0.00134	0.07387	0.00143	0.58434	0.01272		506	21	459	9	467	8		1.74%	459	9
MO17-85	156	353	0.44	0.05626	0.00091	0.05669	0.00104	0.43970	0.00658		463	18	355	6	370	5		4.23%	355	6
MO17-86	26	135	0.20	0.05632	0.00114	0.07932	0.00151	0.61583	0.01147		465	19	492	9	487	7		-1.02%	492	9
MO17-87	102	239	0.43	0.05768	0.00092	0.09390	0.00171	0.74663	0.01104		518	18	579	10	566	6		-2.25%	579	10
MO17-88	99	120	0.83	0.06773	0.00131	0.10491	0.00200	0.97963	0.01748		860	18	643	12	693	9		7.78%	643	12
MO17-89	178	427	0.42	0.05642	0.00093	0.05611	0.00103	0.43642	0.00662		469	18	352	6	368	5		4.55%	352	6

MO17-90	100	213	0.47	0.18429	0.00194	0.50057	0.00895	12.71741	0.12359		2692	17	2616	38	2659	9		2.91%	2692	17
MO17-91	43	146	0.29	0.05826	0.00131	0.07970	0.00156	0.64019	0.01326		540	20	494	9	502	8		1.62%	494	9
MO17-92	147	268	0.55	0.05273	0.00113	0.05551	0.00106	0.40351	0.00799		317	20	348	6	344	6		-1.15%	348	6
MO17-93	41	452	0.09	0.05752	0.00086	0.08076	0.00147	0.64041	0.00876		512	19	501	9	503	5		0.40%	501	9
MO17-94	89	90	0.99	0.05707	0.00168	0.09502	0.00200	0.74760	0.02041		494	28	585	12	567	12		-3.08%	585	12
MO17-95	38	322	0.12	0.05634	0.00094	0.07378	0.00135	0.57301	0.00883		466	18	459	8	460	6		0.22%	459	8
MO17-96	52	183	0.28	0.05771	0.00101	0.07750	0.00144	0.61655	0.00991		519	18	481	9	488	6		1.46%	481	9
MO17-97	65	215	0.30	0.05875	0.00089	0.09446	0.00172	0.76510	0.01065		558	19	582	10	577	6		-0.86%	582	10
MO17-98	61	155	0.39	0.05598	0.00110	0.08888	0.00168	0.68590	0.01240		452	19	549	10	530	7		-3.46%	549	10
MO17-99	47	162	0.29	0.06149	0.00115	0.11732	0.00223	0.99441	0.01716		656	18	715	13	701	9		-1.96%	715	13
MO17-100	19	24	0.78	0.05537	0.00398	0.08074	0.00214	0.61629	0.04288		427	108	501	13	488	27		-2.59%	501	13
MO26-01	143	160	0.90	0.18803	0.00126	12.59283	0.08478	0.48569	0.00543		2725	10	2650	6	2552	24		6.78%	2725	10
MO26-02	226	549	0.41	0.05985	0.00052	0.62440	0.00525	0.07566	0.00083		598	11	493	3	470	5		4.89%	470	5

MO26-03	47	1022	0.05	0.17896	0.00095	10.22385	0.05649	0.41432	0.00439		2643	10	2455	5	2235	20		18.26%		
MO26-04	14	806	0.02	0.05562	0.00047	0.51164	0.00417	0.06672	0.00073		437	12	420	3	416	4		0.96%	416	4
MO26-05	51	560	0.09	0.16104	0.00089	8.32408	0.04764	0.37488	0.00400		2467	10	2267	5	2052	19		20.22%		
MO26-06	113	208	0.54	0.05603	0.00075	0.43589	0.00550	0.05642	0.00067		454	13	367	4	354	4		3.67%	354	4
MO26-07	20	30	0.67	0.07823	0.00186	1.07548	0.02301	0.09971	0.00159		1153	20	741	11	613	9		20.88%		
MO26-08	59	35	1.68	0.12294	0.00169	5.86086	0.07532	0.34574	0.00476		1999	11	1955	11	1914	23		4.44%	1999	11
MO26-09	430	509	0.85	0.05708	0.00056	0.44116	0.00415	0.05605	0.00063		495	11	371	3	352	4		5.40%	352	4
MO26-10	219	568	0.39	0.11633	0.00184	3.65526	0.04107	0.22789	0.00253		1901	29	1562	9	1323	13		43.69%		
MO26-11	276	524	0.53	0.10794	0.00070	3.75312	0.02437	0.25217	0.00274		1765	11	1583	5	1450	14		21.72%		
MO26-12	401	573	0.70	0.06174	0.00050	0.89951	0.00711	0.10566	0.00116		665	11	651	4	647	7		0.62%	647	7
MO26-13	95	296	0.32	0.05768	0.00063	0.66180	0.00687	0.08321	0.00095		518	11	516	4	515	6		0.19%	515	6
MO26-14	231	408	0.57	0.05871	0.00066	0.46021	0.00486	0.05685	0.00065		556	11	384	3	356	4		7.87%	356	4
MO26-15	63	59	1.07	0.12664	0.00126	6.17930	0.05839	0.35387	0.00429		2052	10	2002	8	1953	20		5.07%	2052	10
MO2	67	93	0.	0.06357	0.00	0.88911	0.01	0.10143	0.00		727	12	646	6	623	7		3.69%	62	7

6-16			73		089		165		124										3	
MO26-17	86	130	0.66	0.05688	0.00099	0.61797	0.01001	0.07879	0.00102		487	16	489	6	489	6		0.00%	489	6
MO26-18	75	127	0.59	0.11173	0.00237	4.71664	0.08116	0.30618	0.00381		1828	39	1770	14	1722	19		6.16%	1828	39
MO26-19	181	281	0.64	0.06074	0.00068	0.86815	0.00919	0.10366	0.00119		630	11	635	5	636	7		-0.16%	636	7
MO26-20	219	334	0.66	0.21807	0.00119	16.88388	0.09551	0.56151	0.00600		2966	10	2928	5	2873	25		3.24%	2966	10
MO26-21	70	251	0.28	0.05946	0.00067	0.65702	0.00696	0.08013	0.00092		584	11	513	4	497	5		3.22%	497	5
MO26-22	311	771	0.40	0.05902	0.00044	0.67970	0.00499	0.08353	0.00090		568	12	527	3	517	5		1.93%	517	5
MO26-23	87	198	0.44	0.05813	0.00155	0.65030	0.01550	0.08114	0.00098		535	60	509	10	503	6		1.19%	503	6
MO26-24	173	353	0.49	0.05745	0.00073	0.64320	0.00765	0.08119	0.00095		509	12	504	5	503	6		0.20%	503	6
MO26-25	158	426	0.37	0.06018	0.00057	0.67548	0.00615	0.08140	0.00091		610	11	524	4	504	5		3.97%	504	5
MO26-26	178	738	0.24	0.05942	0.00046	0.65548	0.00494	0.08000	0.00087		583	12	512	3	496	5		3.23%	496	5
MO26-27	110	313	0.35	0.05981	0.00070	0.66880	0.00739	0.08109	0.00094		597	11	520	4	503	6		3.38%	503	6
MO26-28	84	102	0.82	0.05984	0.00090	0.75093	0.01056	0.09102	0.00113		598	14	569	6	562	7		1.25%	562	7
MO26-29	81	135	0.60	0.11996	0.00083	5.71721	0.03936	0.34566	0.00381		1956	10	1934	6	1914	18		2.19%	1956	10

MO26-30	69	183	0.38	0.11913	0.00083	5.33682	0.03671	0.32491	0.00358		1943	10	1875	6	1814	17		7.11%	1943	10
MO26-31	79	201	0.39	0.06451	0.00073	0.79743	0.00845	0.08966	0.00104		758	11	595	5	554	6		7.40%	554	6
MO26-32	37	224	0.16	0.12291	0.00078	5.99219	0.03826	0.35357	0.00384		1999	11	1975	6	1952	18		2.41%	1999	11
MO26-33	142	175	0.81	0.05759	0.00078	0.61487	0.00777	0.07743	0.00093		514	12	487	5	481	6		1.25%	481	6
MO26-34	159	436	0.37	0.17675	0.00098	12.05600	0.06907	0.49470	0.00529		2623	10	2609	5	2591	23		1.24%	2623	10
MO26-35	194	277	0.70	0.06370	0.00058	0.94168	0.00816	0.10722	0.00119		732	11	674	4	657	7		2.59%	657	7
MO26-36	260	467	0.56	0.05500	0.00151	0.42849	0.01066	0.05650	0.00066		412	63	362	8	354	4		2.26%	354	4
MO26-37	200	387	0.52	0.05782	0.00064	0.44763	0.00465	0.05614	0.00064		523	11	376	3	352	4		6.82%	352	4
MO26-38	48	65	0.73	0.19613	0.00139	14.72640	0.10430	0.54457	0.00620		2794	10	2798	7	2803	26		-0.32%	2794	10
MO26-39	56	83	0.68	0.10748	0.00242	3.99429	0.07527	0.26953	0.00333		1757	42	1633	15	1538	17		14.24%		
MO26-40	52	85	0.61	0.11910	0.00089	5.27158	0.03856	0.32102	0.00359		1943	10	1864	6	1795	18		8.25%	1943	10
MO26-41	191	310	0.62	0.06121	0.00059	0.85247	0.00784	0.10101	0.00113		647	11	626	4	620	7		0.97%	620	7
MO26-42	1201	1025	1.17	0.05290	0.00222	0.37755	0.01512	0.05177	0.00064		324	98	325	11	325	4		0.00%	325	4
MO2	23	41	0.	0.06178	0.00	0.83868	0.00	0.09846	0.00		667	11	618	4	605	6		2.15%	60	6

6-43	7	2	57		058		749		110										5	
MO26-44	176	269	0.66	0.06051	0.00062	0.81470	0.00790	0.09764	0.00110		622	11	605	4	601	6		0.67%	601	6
MO26-45	197	355	0.55	0.18293	0.00107	11.76760	0.07021	0.46655	0.00504		2680	10	2586	6	2468	22		8.59%	2680	10
MO26-46	68	206	0.33	0.06094	0.00062	0.75692	0.00732	0.09008	0.00102		637	11	572	4	556	6		2.88%	556	6
MO26-47	50	256	0.20	0.05738	0.00061	0.61304	0.00616	0.07748	0.00088		506	11	485	4	481	5		0.83%	481	5
MO26-48	57	1095	0.05	0.08977	0.00112	1.40673	0.00953	0.11365	0.00119		1421	24	892	4	694	7		28.53%		
MO26-49	31	35	0.91	0.05948	0.00207	0.74759	0.02394	0.09115	0.00170		585	38	567	14	562	10		0.89%	562	10
MO26-50	86	210	0.41	0.05639	0.00147	0.56973	0.01325	0.07328	0.00087		468	59	458	9	456	5		0.44%	456	5
MO26-51	33	237	0.14	0.05728	0.00060	0.61515	0.00614	0.07789	0.00088		502	11	487	4	484	5		0.62%	484	5
MO26-52	317	381	0.83	0.06259	0.00050	0.82372	0.00633	0.09545	0.00104		694	11	610	4	588	6		3.74%	588	6
MO26-53	117	98	1.19	0.11425	0.00087	5.06730	0.03778	0.32167	0.00361		1868	10	1831	6	1798	18		3.89%	1868	10
MO26-54	6	25	0.26	0.05873	0.00235	0.46786	0.01710	0.05777	0.00119		557	45	390	12	362	7		7.73%	362	7
MO26-55	141	484	0.29	0.12887	0.00075	6.70974	0.03953	0.37761	0.00405		2083	11	2074	5	2065	19		0.87%	2083	11
MO26-56	68	193	0.35	0.06081	0.00066	0.65585	0.00671	0.07822	0.00089		633	11	512	4	485	5		5.57%	485	5

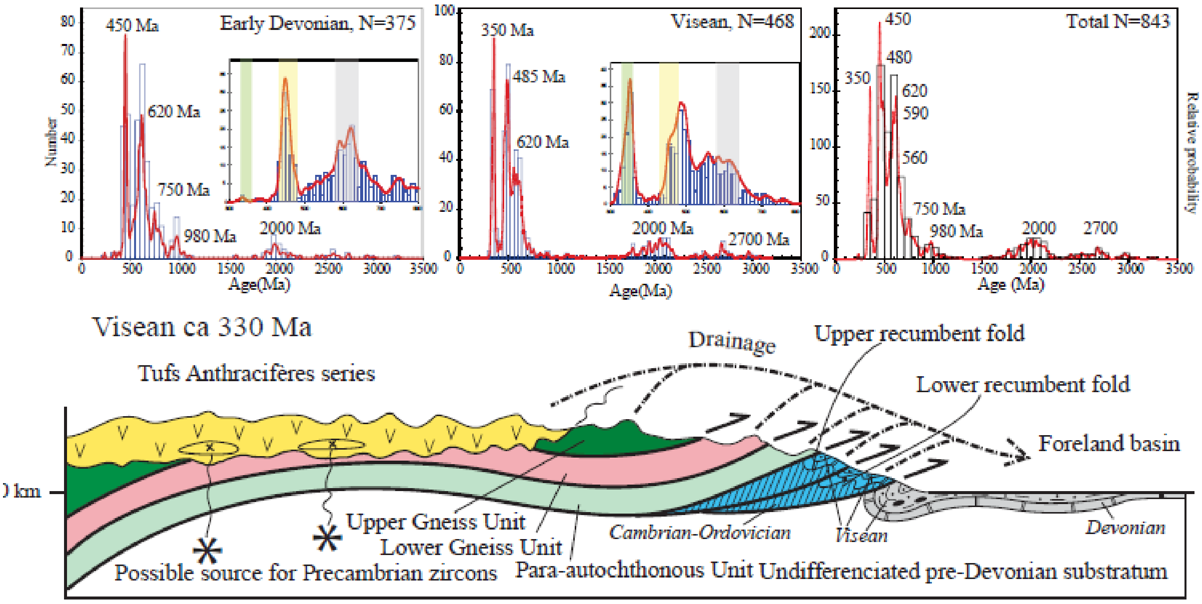
MO26-57	113	339	0.34	0.05475	0.00056	0.41882	0.00408	0.05548	0.00062		402	11	355	3	348	4		2.01%	348	4
MO26-58	125	441	0.28	0.07512	0.00178	1.54637	0.03220	0.14929	0.00171		1072	49	949	13	897	10		5.80%	897	10
MO26-59	321	555	0.58	0.06185	0.00047	0.88309	0.00658	0.10355	0.00112		669	11	643	4	635	7		1.26%	635	7
MO26-60	156	490	0.32	0.07912	0.00052	1.58083	0.01021	0.14491	0.00156		1175	12	963	4	872	9		10.44%		
MO26-61	203	315	0.65	0.12772	0.00073	5.35542	0.03102	0.30412	0.00325		2067	11	1878	5	1712	16		20.74%		
MO26-62	131	270	0.49	0.06320	0.00061	0.78723	0.00722	0.09034	0.00101		715	11	590	4	558	6		5.73%	558	6
MO26-63	308	218	1.41	0.06280	0.00058	0.83702	0.00731	0.09667	0.00108		701	11	617	4	595	6		3.70%	595	6
MO26-64	457	773	0.59	0.05625	0.00042	0.43381	0.00318	0.05593	0.00060		462	12	366	2	351	4		4.27%	351	4
MO26-65	23	48	0.48	0.12182	0.00125	4.80734	0.04637	0.28622	0.00347		1983	10	1786	8	1623	17		22.18%		
MO26-66	231	382	0.60	0.05990	0.00048	0.78158	0.00607	0.09464	0.00103		600	11	586	3	583	6		0.51%	583	6
MO26-67	256	824	0.31	0.05845	0.00040	0.56272	0.00384	0.06983	0.00075		547	12	453	2	435	5		4.14%	435	5
MO26-68	708	723	0.98	0.06454	0.00049	0.80889	0.00597	0.09091	0.00099		759	12	602	3	561	6		7.31%	561	6
MO26-69	734	1897	0.39	0.06188	0.00039	0.62287	0.00389	0.07301	0.00078		670	13	492	2	454	5		8.37%	454	5
MO2	16	18	0.	0.05963	0.00	0.78332	0.00	0.09527	0.00		590	11	587	4	587	6		0.00%	58	6

6-70	0	7	86		060		753		107										7	
MO26-71	106	239	0.44	0.05620	0.00060	0.43608	0.00442	0.05627	0.00064		460	11	367	3	353	4		3.97%	353	4
MO26-72	146	403	0.36	0.12369	0.00067	5.98967	0.03359	0.35121	0.00373		2010	11	1974	5	1940	18		3.61%	2010	11
MO26-73	162	256	0.63	0.06502	0.00053	1.04088	0.00820	0.11610	0.00127		775	11	724	4	708	7		2.26%	708	7
MO26-74	137	269	0.51	0.06079	0.00053	0.70827	0.00592	0.08450	0.00093		632	11	544	4	523	6		4.02%	523	6
MO26-75	146	133	1.10	0.12566	0.00083	6.19140	0.04080	0.35735	0.00391		2038	10	2003	6	1970	19		3.45%	2038	10
MO26-76	17	30	0.57	0.06437	0.00149	0.80006	0.01695	0.09015	0.00135		754	22	597	10	556	8		7.37%	556	8
MO26-77	138	274	0.50	0.05403	0.00060	0.40260	0.00419	0.05404	0.00061		372	11	344	3	339	4		1.47%	339	4
MO26-78	327	637	0.51	0.05400	0.00044	0.40374	0.00320	0.05423	0.00059		371	12	344	2	340	4		1.18%	340	4
MO26-79	168	350	0.48	0.05848	0.00138	0.64345	0.01335	0.07980	0.00091		548	53	504	8	495	5		1.82%	495	5
MO26-80	25	81	0.30	0.05932	0.00090	0.63557	0.00898	0.07770	0.00096		579	14	500	6	482	6		3.73%	482	6
MO26-81	20	53	0.37	0.13658	0.00114	7.32111	0.05899	0.38877	0.00451		2184	10	2151	7	2117	21		3.16%	2184	10
MO26-82	50	671	0.07	0.05896	0.00045	0.65027	0.00483	0.07999	0.00087		566	12	509	3	496	5		2.62%	496	5
MO26-83	281	493	0.57	0.05987	0.00043	0.78658	0.00553	0.09529	0.00103		599	12	589	3	587	6		0.34%	587	6

MO26-84	111	249	0.45	0.05649	0.00056	0.61555	0.00582	0.07903	0.00089		472	11	487	4	490	5		-0.61%	490	5
MO26-85	48	268	0.18	0.12717	0.00092	6.05203	0.04276	0.34516	0.00384		2059	10	1983	6	1911	18		7.74%	2059	10
MO26-86	201	426	0.47	0.05445	0.00051	0.40660	0.00364	0.05416	0.00060		390	11	346	3	340	4		1.76%	340	4
MO26-88	264	294	0.90	0.05883	0.00055	0.74037	0.00659	0.09127	0.00101		561	11	563	4	563	6		0.00%	563	6
MO26-89	166	274	0.61	0.06061	0.00072	0.78952	0.00884	0.09448	0.00110		625	11	591	5	582	6		1.55%	582	6
MO26-90	90	70	1.29	0.12580	0.00103	6.44358	0.05123	0.37149	0.00427		2040	10	2038	7	2036	20		0.20%	2040	10
MO26-91	55	276	0.20	0.16575	0.00213	10.03074	0.07057	0.43892	0.00471		2515	22	2438	6	2346	21		7.20%	2515	22
MO26-92	58	600	0.10	0.06886	0.00043	1.12881	0.00710	0.11889	0.00127		895	12	767	3	724	7		5.94%	724	7
MO26-93	505	819	0.62	0.06245	0.00042	0.86075	0.00566	0.09996	0.00107		690	12	631	3	614	6		2.77%	614	6
MO26-94	134	101	1.33	0.12633	0.00083	6.16925	0.04033	0.35417	0.00387		2048	10	2000	6	1954	18		4.81%	2048	10
MO26-95	119	247	0.48	0.12748	0.00077	6.16356	0.03724	0.35065	0.00377		2064	11	1999	5	1938	18		6.50%	2064	11
MO26-96	330	981	0.34	0.05514	0.00038	0.46639	0.00318	0.06135	0.00066		418	13	389	2	384	4		1.30%	384	4
MO26-97	27	52	0.51	0.15649	0.00116	9.15768	0.06628	0.42443	0.00481		2418	10	2354	7	2281	22		6.01%	2418	10
MO2	13	19	0.	0.06311	0.00	1.02176	0.00	0.11743	0.00		712	11	715	5	716	8		-0.1	71	8

6-98	8	0	73		063		965		133									4%	6	
MO26-99	181	255	0.71	0.13196	0.000075	6.91472	0.040008	0.38003	0.004006		2124	11	2101	5	2076	19		2.31%	2124	11
MO26-100	40	61	0.65	0.06028	0.00120	0.74059	0.01358	0.08910	0.00123		614	19	563	8	550	7		2.36%	550	7

Graphical abstract



Schematic topographic reconstruction of the French Massif Central during the Visean and the possible sources for the detrital zircons of the Foreland basin with the cumulative probability plots of detrital zircon U-Pb ages.

Highlights

Variscan Southern Massif Central Foreland basin helps to decipher tectonic events

Early Devonian and Carboniferous detrital zircon provenance is investigated

11 samples yielded U-Pb age spectra ranging from Neoarchean to Late Paleozoic

Rifting, volcanic, and plutonic events with a multi-recycling history are suggested